

No.
60

THE MAGAZINE OF TOMORROW

AUTHENTIC SCIENCE

FICTION MONTHLY

2/-



NEW
LARGE
SIZE

• Prof. A. M. Low • Dr. A. E. Roy
Frank Wilson, B.Sc.

FULLY
ILLUSTRATED

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AUTHENTIC SCIENCE

FICTION MONTHLY

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H.J. Campbell writes

news and views from the editor

HERE WE ARE, THEN, WITH our new LARGE issue, as promised. We have crammed it so full of such interesting features that I'm sure you won't begrudge the extra sixpence we told you we'd have to charge for it. With regard to subscribers, those who have taken out a one-year or two-year subscription will continue to receive the magazine until the period of their subscription expires. Those who pay as they receive the magazine will be asked to pay the increased price immediately.

One of the new features starting with this issue is a new cover series. In this I hope to show you some current aspects of applied science, with an eye on the future. If there's any device or development that you'd especially like to see on our cover, let me know and

I'll do my best to fit it in. These covers are designed in complete co-operation with the manufacturers and designers. You can bet your life they are as accurate as our reputation requires.

Although I'm giving you a wide range of intelligent and instructive non-fiction, yet I've spent the same care on the selection of the stories. The lead novel I'm sure you will like; Tubb at his slightly cynical best. The rest of them cover quite a gamut of plot patterns, chosen to give you a sampling of several types of science fiction—with the exception of space opera! Tell me what you think of them.

Meantime, I'm cutting down the length of my editorials so that I can tell you more about the cover. Okay?

H.J.C.

About the cover . . .

. . . Guided Missiles

OUR ARTIST, IN CO-OPERATION with guided missile designers, depicts a vertical take-off (v.t.o.) rocket that is now undergoing tests. As with all such rockets it is strictly a one-way job; it is not intended to come back!

Pilotless and guided by radio beams, this modern device brings back memories of the "Queen Bee," first radio-controlled aircraft, developed in Britain. The Queen was a much more conventional ship, though—a biplane and gawky. But it was the wonder of the day, and spaceship design had hardly been born! In one way, however, it was a nicer ship than its modern counterparts—it was not meant for destruction.

Current V.T.O. pilotless guided rocket projects are concerned almost solely with getting a hefty (atomic?) warhead to an enemy as quickly and as accurately as possible. It is said that pin-point accuracy of aim is possible within a range of a couple of hundred miles with the latest machines. The present idea is to increase that range to a couple of thousand

miles. Even though these transonic machines cost hundreds of thousands of pounds, service chiefs consider them well worth the money. If one or two rockets can destroy a city, they say, the peculiarly distorted economy of war is tilted in the rocket-owners' favour.

On the brighter side, these guided missiles are also being tested for freight transport, particularly mail. At the Woomera range in Australia, work is rapidly going ahead on various delta-wing rocket powered guided postal vessels. One interesting aspect of some of these models is that one of the jets is capable of being swivelled laterally, so giving controlled change of thrust line.

If the present rate of development continues—and there is every sign that it will—only comparatively slow luxury passenger planes will carry pilots. The bulk of the world's air freight will go by radio-controlled rocket. Still, this is a concept that has been in science fiction for a quarter of a century.

PLANTS against DISEASE

by PETER SUMMERS

MENTION ANTIBIOTICS AND PEOPLE think of diseases, doctors, injections, penicillin, and it is not difficult to see why. Penicillin caught the public's imagination during the war and it has stayed in their minds ever since. Everyone knows the romantic story of its chance discovery, in 1928, by Fleming, and of its subsequent isolation and purification by Florey at a critical stage in the war. Penicillin was the first antibiotic to be used medically and it is still the least toxic. Even at a dilution of 1 to 80 millions it is still effective against the staphylococcus bacterium—truly a wonder drug. It has its slightly seamy side in that it occasionally produces annoying side reactions in the patient (such as rashes and vomiting) which show that it should be used with care and discretion, especially in the large doses that are often given nowadays.

The discovery of penicillin led to a

search for other such compounds, and many fungi were examined with a view to finding another drug. As is usual in science much patient research was undertaken in many labs before new antibiotics were found. Antibiotic activity can be demonstrated in many plants and animals but, on the whole, it is far too toxic to the host to be of use to man. Strangely enough, it is the lowly fungi and bacteria that produce our medical antibiotics; organisms nearer to us on the evolutionary scale are useless for this purpose.

We now have other antibiotics in use, such as streptomycin, auromycin and chloromycetin, and they are doing useful work in supplementing penicillin's action or in attacking bacteria that are resistant to penicillin. Streptomycin is being used with success against the tubercle bacillus, one of the few drugs to attack this bacterium.

Antibiotics look as if they have come to stay in the medical field; Dr. Henry Welch, at the recent Second Annual Symposium on Antibiotics, said that few of his large audience would not have some friend or relative who had not been made well, or even been saved from death, through the use of antibiotic drugs. Probably, very few readers do not know someone who has had an infection cleared like lightning compared with the methods used before antibiotics.

Resistant strains are beginning to rear their heads, but are not a big problem at the moment. With a disease (such as myxomatosis or



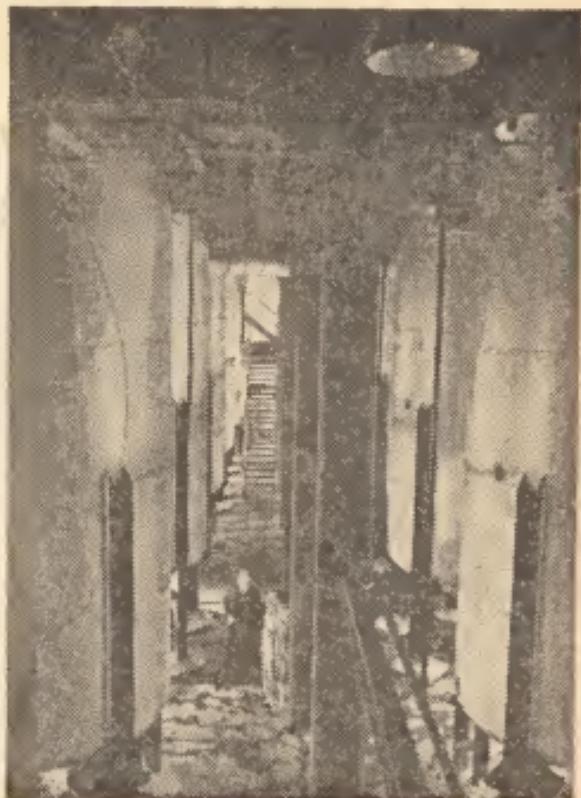
measles) or any drug (such as penicillin) there are some resistant individuals. Some greenfly are not killed by the DDT spray; some fungi are not killed by the copper spray. These are the individuals which help to produce a resistant strain, and it has been said that the more frequently the staphylococci in a particular community are exposed to a particular antibiotic, the more likely they are to become resistant to it. The routine practice of treating with penicillin all new-born babies who have a staphylococcal infection has now largely been dropped, unless the infection is bad and the baby's life is in danger. Better this than the baby becoming resistant to penicillin in later life, when the outcome might be vital. Although it is individuals who succumb a little later to an infection than their colleagues who help to make a resistant strain, it is the species and not the individuals who are resistant. The individuals pass on their properties to offspring and die long before any change is seen in the population.

Man has tried for years to make drugs to cure disease, and now the lowliest of plants are showing him the way. These plants make compounds that a chemist, equipped with the most modern apparatus, would take several days to make if, indeed, he could make them at all. The antibiotics used medically have not been made in the laboratory, although many people are trying to perfect a method of synthesis.

The making of drugs is a haphazard process—the chemist makes hundreds of compounds which are tested and sorted until the likely ones may be given trials on

patients. For each one of these, there are hundreds that never leave the labs, and as long as we do not know why these compounds act as they do, this state of affairs will continue. Chemotherapy (the treating of diseases with drugs) dates from the German chemist, Ehrlich. His most successful drug was Salvarsan, which completely revolutionised the treatment of syphilis in his time, as penicillin has done in ours.

Antibiotics are certainly important to us and they play an almost essential part in our lives, but why are they made in the first place? What makes a plant produce such compounds and why are they useful to man against bacteria that the plant never meets? Although antibiotic production is widespread, it can best be demonstrated in the



bacteria, actinomycetes and fungi (moulds, toadstools and bracket fungi). Penicillin is the only antibiotic in use that is produced by a fungus; most of the others come from the actinomycetes—a subdivision of the bacteria.

Opinions differ on the reason for the antibiotic activity of such plants. Some say that the substance is made, apparently, by pure chance, and just stored until man comes along and finds a use for it. Others say that no antibiotics have been produced outside a factory or laboratory and need luxury conditions and rich media before they are formed. Still others say that these substances are produced normally by these plants, in the battle for existence and food. Evidence is mounting for the latter viewpoint.

The plants mentioned above which produce antibiotics normally live in the soil. Their food consists of dead organic matter, and a hypothesis has been put forward that these substances are produced to kill off neighbouring plants, so providing more available food for the antibiotic-producers. Much work has been done on these naturally produced antibiotics—they have never been restricted to the medical world.

Research of great importance was done by Richard Weindling in 1930. He was working in Florida on a disease of citrus seedlings known as "damping off"—he found that this disease was caused by a fungus, and that this fungus was restricted in its growth by another fungus, normally present in the soil. Weindling found that although the soil-fungus actually penetrated the plant-fungus "stems" and could be said to be parasitic on it, yet it was also able to kill the fungus at a distance. This discovery was highly

important and, of course, it paralleled that of Fleming. Weindling found that often the plant-fungus would die when the soil-fungus was put in the vicinity and in 1936 he succeeded in isolating the lethal principle. This work was a great piece of research and it came several years before the world-wide publicity of penicillin.

Later a penicillium mould was found to be effective against a fungal seedling disease of grasses by A. van Luijk in Holland, and this substance, when isolated, was found to be identical with one discovered in England. Although this work would seem to be fairly conclusive—that penicillin-like substances are quite common in our gardens—there are several points against this view.

Antibiotics are stable only in neutral solutions and very rarely is a soil neutral in action. A slightly acid or slightly alkaline soil is much more common and these would soon destroy the antibiotic. Bacteria capable of destroying penicillin are very common

Continued on page 11



Photos—Glaxo Laboratories

Our Invisible Shield—2

by KENNETH JOHNS

LAST MONTH, IN OUR EXPLORATION of the blanket of air enclosing the Earth, we had gone straight up to a height of just over nine miles.

Already, from the viewpoint of the spaceman, we are far divorced from the thick lower levels and must seek to sustain life by all the weapons in the scientists' armoury.

At a height of eleven miles there begins a large increase in the concentration of primary cosmic rays. Cosmic rays are still the subject of much thought and investigation—it is considered that they are charged particles, mainly protons, travelling at speeds approaching that of light. On the surface, we are subjected to a continuous bombardment of secondary rays, together with a few primary that have managed to batter their way through the atmosphere.

About half the cosmic rays entering the atmosphere are absorbed between eleven and thirteen miles up, the remaining half being absorbed be-

tween thirteen and twenty-two miles. Because of the complex production of secondaries, the greatest concentration is experienced at about twelve miles high.

The rays come from all directions into the air, from somewhere in space, are absorbed, forming neutrons which collide and react with nitrogen atoms to form radioactive carbon-12 and tritium.

Tritium is the isotope of hydrogen used in the hydrogen bomb. Sometimes a cosmic ray hits an atom so violently that it disintegrates directly to form tritium. Radio-active carbon-12 and tritium are absorbed by all living creatures from air and water to make their bodies slightly radioactive.

Tritium has a half life of twelve and a half years and all the waters of the Earth contain only two pounds of the substance.

The contrast between the amount of tritium and the incidence of its manufacture is

edifying. One tritium atom is formed over every ten square centimetres of the Earth's surface per second—and yet the amount to be found is so slight that it is detectable using only the most accurate of instruments.

Animals sent up to eighteen miles—in balloons carrying sealed chambers with full breathing equipment—show distinct signs in their tissues of severe damage by heavy primary cosmic rays. Our atmosphere does protect us very efficiently from these cosmic particles, even though it is responsible for their production of secondaries, acting in the way a stone battlement protects a soldier from the missile, but fills the air with dangerous flying chips of stone. There is no direct evidence to point to any great damage to life on our surface from these bombardments; but the tissue damage of those animals which have been sent up into the regions of primary radiation clearly indicates that the problem of protection will need great and intensive effort if it is to be solved.

We noted that at twelve miles high the intensity was at its peak, approximately fifty

times that at sea level. Above this height intensity slackens and levels off at about fifteen times ground level. An aluminium shield would have to be over six inches thick to be as effective as the remaining air above fifteen miles.

The dangers to be expected from cosmic rays are still very much unknown. At one time, they were considered to be grossly over-rated, instances being cited of men who had spent some time at levels where the radiation intensity was as high as it is in space without suffering ill-effect. After specimens of *Drosophila* fruit-flies—as indispensable to the geneticist as the slide-rule to the physicist—ascended in a V-2 and were recovered safely, the cosmic ray danger was thought to have been overestimated. Now, we are not quite so sure.

Ascending further through the atmospheric shell, at fifteen miles there is still enough air for the sky to appear blue, due to the refraction and scattering of the shorter wave lengths of visible light. This effect is caused by the molecules of the atmosphere and not by dust, which causes the red sunset effect. And now there is only four per cent. of

the whole of Earth's air between us and true space.

At a level between fourteen and fifteen miles occurs the phenomenon protecting us all from permanent sun-burn. Here is the greatest concentration of ozone acting as a blanket to protect us from the intense ultraviolet radiation from the sun. Most of this radiation comes from the sun's corona. About five per cent. of the whole of the sun's radiation is ultraviolet.

Almost all of this ultraviolet radiation is absorbed before reaching the surface. Between a third and a half of the sun's radiation falling on the upper atmosphere is absorbed before it reaches the surface and is then reflected or re-emitted into space. What might have been the course of animal evolution if ultraviolet rays were able to fall unimpeded onto the primeval seas poses some pretty problems, all the more striking in view of experiments designed to uncover those facts. Assuming that we would have evolved along lines similar to those we have, and that the radiation had not precluded life in entirety, might we not now be riding our ships across space, freed from the

pall of air that surrounds our planet?

As it is, no solar radiation of a wave length less than 2863 Angstrom units reaches us on the surface.

Most of the protecting ozone is in a layer only half a mile thick, called the ozonosphere. Compressed to sea level pressure, it would form a layer little more than one eighth of an inch in thickness. The concentration of ultraviolet in sunlight at the surface of the Earth is greater in the morning than in the afternoon, a useful fact to parade should you be hustled onto the beach before lunch!

This ozone consists of molecules containing three atoms of oxygen and is formed by the action of the ultraviolet light on simple molecules of oxygen containing two atoms. Ultraviolet light is not only absorbed during the formation of ozone but also during the decomposition to simple oxygen. There is something of the mystic pre-ordained and inevitable about this blockage of ultraviolet by its own action. Something reminiscent of vaccination, the eradication of unwanted attributes by preparatory use of those very

attributes themselves. There is no ozone above sixteen miles altitude, and at eighteen miles there is too little oxygen for the compressors of turbojets. From now on there is no dynamic power that can challenge the supremacy of the rocket.

Above twenty-two miles there is no absorption of cosmic rays. Of all the air surrounding the Earth, 99 per cent is below an altitude of twenty-five miles. The gassy crust is being pierced—and yet there is still activity, still something to learn about that one per cent. balance.

Between fifty and seventy miles lies the region in which most meteorites are destroyed. Their speeds vary between seven and forty-five miles per second; sufficiently fast for the mere wisps of air at this height to heat them enough to destroy all but the very large and the very small.

The apparent contradiction here is another example of the way the forces of nature work. The large ones are not consumed before they reach the surface, where they are greeted with great interest. The small ones are quickly slowed down and have such a large area to weight ratio that

they quickly lose their heat by radiation. They drift down as—dust.

Samples of air brought back by rockets from a height of forty-four miles show that from here upwards there is a higher concentration of the lighter gases, such as hydrogen and helium, than is found at sea level. Reactive gases such as formaldehyde and the oxides of nitrogen are formed by the absorption of energetic solar radiation by the air.

Above seventy miles diatomic oxygen, such as we breathe, no longer exists and all the remaining oxygen is in the form of single atoms. This is a result of ultraviolet radiation which, lower down, cancels itself out.

Ninety miles is the mark at which spacemen will feel that they are coming home. Here there is not enough air to scatter sunlight. The sky appears black. The stars shine proudly as they do in outer space. And yet, even as high as this, there are further limits still at which the outer border of our invisible shield may be set.

The mechanical border of space lies at 120 miles. Here, the resistance of air is negligi-

ible. Rocket engineers usually refer to this border as the beginning of space—but there is still air, however attenuated, around the spaceship.

At 185 miles the air absorbs enough solar radiation to raise it to 1,300 degrees Centigrade; and occasionally the excess outbursts from solar flares raises it to 2,315 degrees.

At last, at 600 miles up, the last traces of atmosphere can be detected only by the way in which they are ionized by charged particles from the sun. They create the streamers of coloured light, mainly red and green, known as the aurora borealis, the Northern Lights.

In about two years time, scientists will send off a three stage rocket to put a small

satellite in orbit at 250 miles. This will not be the giant space station so readily envisaged, but a small, football-sized sphere crammed with a payload of fifty pounds of expensive equipment, triggered to telemeter information back to Earth.

At 250 miles, the rocket engineers will say that their station is circling in space. But, above them, the weirdly pulsing light of the aurora borealis plainly shows that space is still far away, remote and cold.

Humanity has grown up under the protective embrace of its invisible shield and is ready to kick off the covers, to venture out and up, into the great nothingness, leaving behind the mysteries that acted as its giant incubator.

PLANTS AGAINST DISEASE

Continued from page 6

in soil, and no antibiotic activity has been demonstrated in soil which has not been enriched with added plant material. It is certainly a tricky problem, and one that is keeping many people occupied.

The medical aspect is the one that most people find important and interesting—these compounds have certainly come near to some of man's dreams of healing drugs. In their swift action and wonderful thoroughness, few could be blamed for thinking that we held a universal cure-all within our grasp.

For exactly how long we hold it is another matter. If we continue to use these drugs research will always have to be one step ahead—finding new drugs when the bacteria are resistant to the old ones. There must come a time (however long hence) when there are no new compounds to be found. Surely then we might be in a worse position than if antibiotics had never been discovered? Prophylaxis—the study of the prevention of disease—is still the best plan if we are taking a long-term view of medicine.

Positronium

"HYDROGEN!" SCOFFED THE professor. "Oh, no! My airship uses a much lighter substance than that!"

Most people must have read a story in their youth with a line similar to that embedded in the "scientific" explanations. Later, the knowledge that hydrogen is the lightest known gas throws a tarnish over the glamour of stories that postulate otherwise. It's like learning about Father Christmas.

But if there is one outstanding fact in this changing world, it is that science never stands still. The research chemists and physicists, all scientists engaged on pioneer work, are always probing ahead into the future, trying to uncover more of the secrets of the universe.

And—inevitably—they come up with discoveries that often vindicate old-time prophecies. Like there being something lighter than hydrogen.

The hydrogen atom is an electrically neutral system in which a negatively charged electron circles a positively charged proton, the latter having 1,836 times the mass of an electron. This system is rather like a sub-microscopic Earth-Moon system, visualised purely from the particle angle.

Now, however, physicists have dis-

covered a new type of matter containing no protons or neutrons but which is still electrically neutral. It is made up of only electrons and positrons. Positrons are positively charged electrons.

One electron and one positron, by revolving around one another held together by their electrostatic attraction, combine to form a positronium atom. This atom is very short lived and, because a positron has the same mass as an electron, the positronium atom has a mass almost a thousandth of that of a hydrogen atom.

In positronium, the electron and the positron move around their common centre of mass rather than one of them around the other, so that the distance between them is twice that between electron and proton in a hydrogen atom. Bringing the concept back onto the macrocosmic scale, it may be compared to a binary having two stars of equal mass.

Positronium is formed for a fleeting moment after the emission of a positron by a radio-active atom and has an average life of less than a millionth of a second. The positronium destroys itself by the two particles cancelling each other out with the



any radiation until both are activated at the same time. At the Massachusetts Institute of Technology they found that sometimes positronium formed two gamma rays and sometimes it formed three. The latter reaction was discovered by placing a radio-active source at the centre of the three counters arranged at 120 degrees to each other so that they only counted if all three were activated at the same time. From this it was postulated that there are two types of positronium, and it was calculated that they should have different average lifetimes.

The two varieties have been named ortho-positronium and para-positronium. The former emits three photons and has an average lifetime of 1.4×10^{-7} seconds, one seven millionth of a second. Para-positronium emits two photons and has an average life of 1.25×10^{-10} seconds, one eight thousand millionth of a second.

Their characteristic average lifetimes, as found by experiment, agree with those calculated from theory.

The positronium atom

formation of two or three photons, which are packets of electromagnetic energy.

From Einstein's conservation of mass and energy we know that with the disappearance of the two particles' mass there must be an equal amount of energy formed and this is equivalent to a million electron volts. If two photons are formed they have half a million electron volts each and appear as gamma rays shooting off in opposite directions to one another.

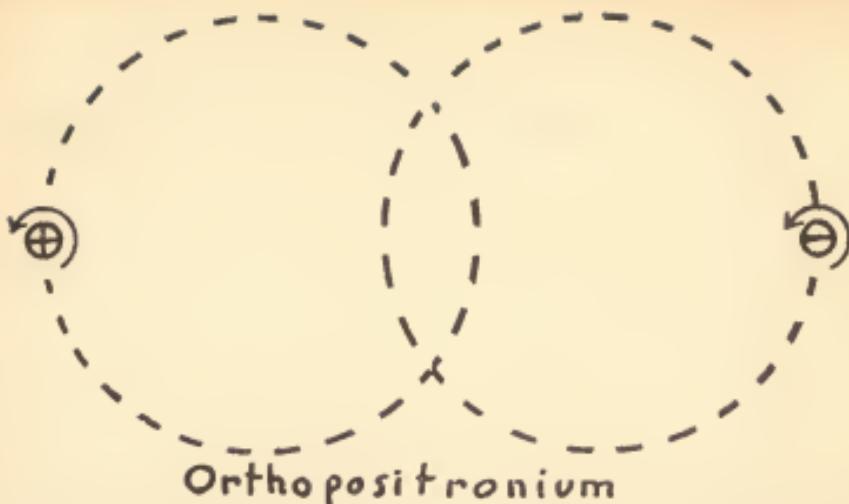
Positronium can only be detected by its death cries, the gamma rays that it evolves as it annihilates itself.

This is seen by placing a radio-active source exactly on the line between two Geiger or scintillation counters so interconnected that they will not count

Decay of Positronium



Photons



Orthopositronium

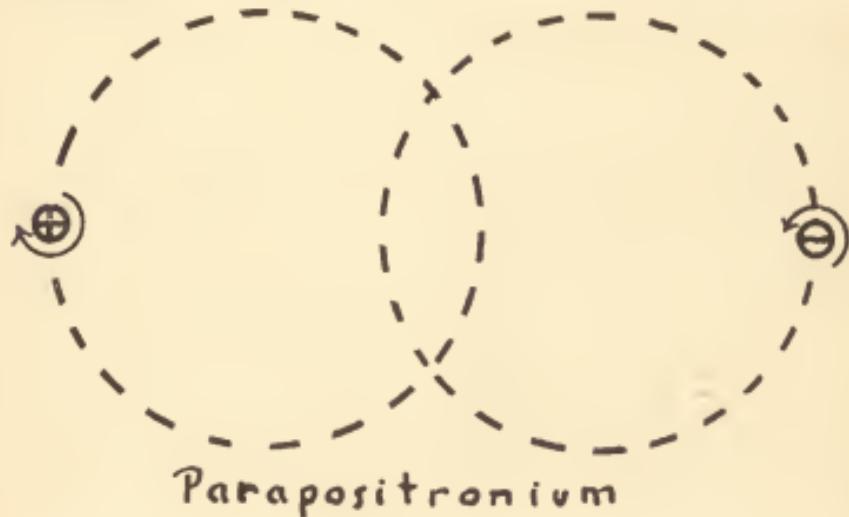
Whilst they are incredibly short from our point of view, by atomic standards they are quite lengthy. There is time enough for the two particles to circle one another at least a million times before annihilation. Thus there is time enough for us to study the properties of this new form of matter.

Using the older picture of the atom uncomplicated by wave mechanics, the difference between the two types is seen to be due to the spins of the particles.

As the planets of the solar system spin on their axes, so do electrons. If the spin of the positron and the electron are in the same direction so that they seem to roll around the invisible centre of their system, they form orthopositronium. If they have antiparallel spins their angular momentums cancel one another and they form parapositronium.

Ortho-positronium with one unit of spin has more energy than the para and

Continued on page 130



Parapositronium

We're not optimistic enough

BY E. LORING WARE

THE MOON BY 1970—MARS by the year 2000! This is often given as a reasonable prediction of our progress in space flight. Other more practical people claim the launching of our first unmanned artificial satellite won't take place until the year 2000. Dr. Von Braun's programme would have us on Mars soon after its start, but there are no indications at present that the necessary billions will be forthcoming.

I believe that these prophets are wrong and I will try to describe why. Beginning around 1900 with the realisation that man would eventually fly; gaining impetus with the early flights and continuing with full force to the present—there has been a large and continually growing mass of prophecy regarding our future command of our environment, the bright and

glowing life of the future and the sheer drama and magnificence of the expected developments. Perhaps you have seen reprints of some of the early articles or perhaps you have been lucky enough to see one or two of them in the original editions. The important thing we are concerned with here is that they were written to show the huge changes that would take place, and yet—one thing stands out in virtually all of them: *their lack of imagination*. The extreme conservatism of their prophesies is obvious from our vantage point in their future. They were taking their present (say 1905) and milking the possibilities of that year dry in an indefinite extension of 1905's on into the future. No one, of course, can do more in attempting prediction. The huge changes that have actually taken place would not only have amazed

our citizen of 1905, but in many cases would have been completely *outside his comprehension* (the polaroid filter, the electron microscope, radio astronomy, the analog computer and, of course, atomic energy).

Two things need to be mentioned at this point which form the basis for my "prediction about prediction." Firstly, for the last several hundred years progress has not been in a straight line. It has enjoyed a constant acceleration, reaching breathtaking proportions at present and, in spite of short-sighted policies, has not yet shown any signs of levelling off (abstract speculation included) and secondly in the art of prophecy we are no more expert, at present, than our ancestors.

Our own predictions, of necessity, take the form of an indefinite extension of 1955's in order for us to visualise the completion of schemes and plans already formed. However, if we are to learn anything from previous attempts at prophesy we must admit our inability to imagine well enough and think large enough. By extension from our past, we are actually

unable to comprehend the developments in our future.

In short: *we will have explored every planet in our own solar system by the year 2000, and by the year 2050 we will have landed on at least one planet of another star!*

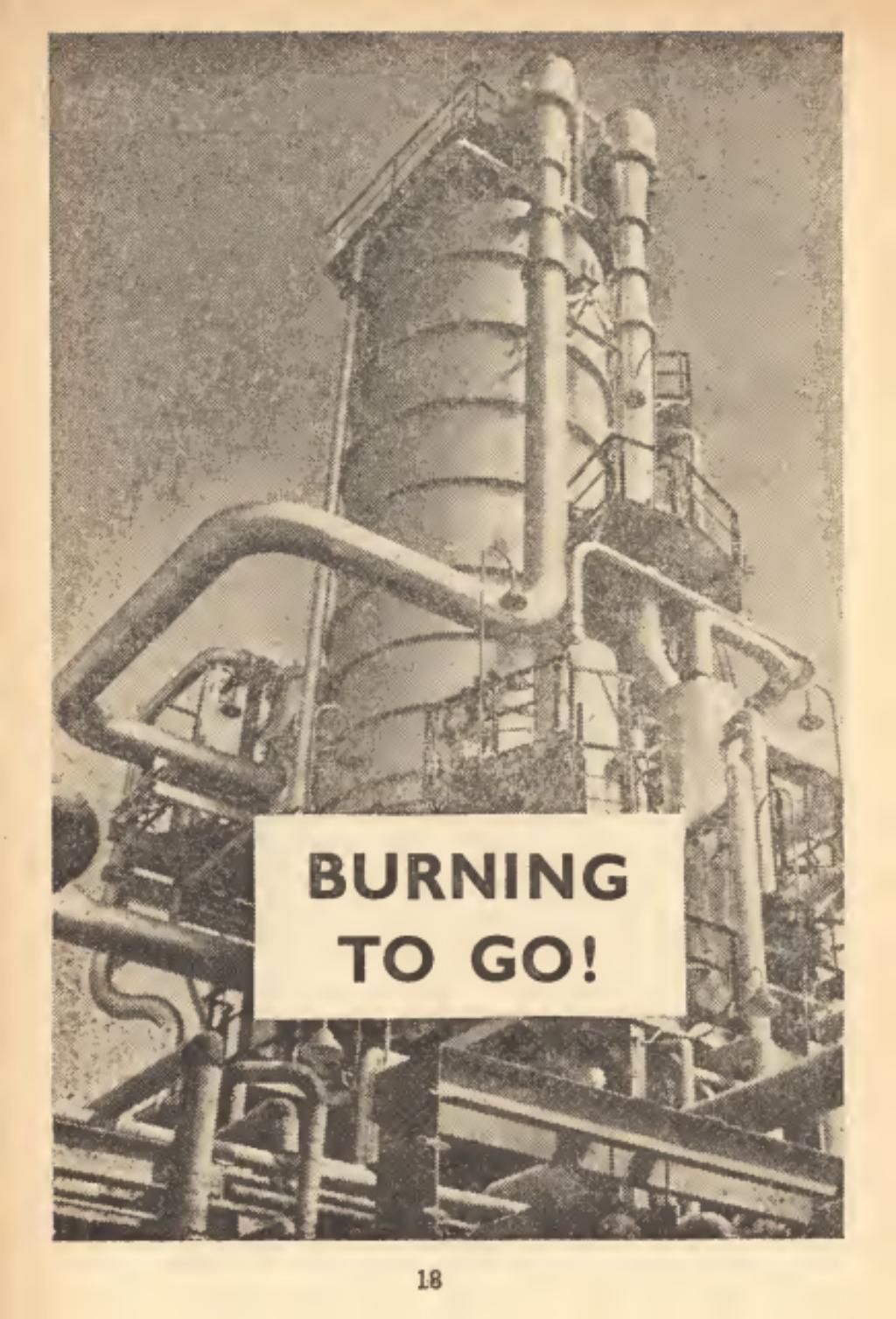
There are several points I would like to make which may or may not have a direct bearing on the statement above. First is the definite and directed military interest that would be reinforced by increased threat of another war, although this may not be as important in the rapid conquest of space as we usually think. Second, there may be reinforced work on the subject from those in which the preservation of the race in the form of extra-terrestrial colonies becomes subconsciously imperative. Third, and perhaps most important, the imagination of a large segment of the population has been aroused in completely unprecedented fashion. Even to the children—or perhaps most of all the children—who expect to travel into space when they grow up. Fourth, after the first step has been taken, terrific opportunities will become available for original research on the space

station or the Moon which will make many Earth labs obsolete overnight. Fifth, perhaps, is the mystical philosophical principle which intimates that whatever man can imagine and want he can get, although in surprising forms at times. (What did Icarius know about wing loading?)

The first starship should lead to almost *immediate galactic travel!* To illustrate this statement I'll digress for a moment. Pretend you have never read science fiction and imagine, if you will, a galaxy of billions of stars. Life has developed through an impossible set of circumstances, which could never be repeated, on only *one* planet. The recent reasonable and conservative estimate of over a million planets throughout the Galaxy then becomes a large number of barren and lifeless worlds. Then suddenly (imagine) it becomes known that somewhere at the other end of the

galaxy there existed another planet with life. Our ideas as to the uniqueness of life, the zero probability of life happening again and some religious beliefs then become radically revised. And yet we, not unique after all, may look upon a world in the *same solar system* under conditions that were always *more* severe than our own and observe life through the changing seasons on Mars. I would consider, then, that we, as sometimes sentient beings are almost certain to be echoed throughout the galaxy. I am suggesting that when the first starship is ready to leave (or before) we will be visited and assisted into partnership with those races within the galaxy who have already achieved star travel.

Of course, if we have an atomic war disregard all of the foregoing and learn how to chip flint in a hell of a hurry.



**BURNING
TO GO!**

VERY RARELY NOWADAYS DO WE go anywhere without making something burn to enable us to do so.

When we walk on our own two legs the extra carbon dioxide and water vapour in our exhaled air are evidence of the combustion of the carbon and hydrogen that were in the sugar on our breakfast cereal. The bus we use to get to the station burns petrol or diesel oil. The train we catch may burn coal or be powered by electricity generated by the burning of coal at the power house. If we fly in the air we do so on the strength of burning volatile oils. There was a time when considerable cargoes were moved across the oceans by wind power, but nowadays the sail is used only for small craft, and by those of this island breed whose joy it is to make sport upon the waters. As far as we can see our travels in the future will involve the burning of something.

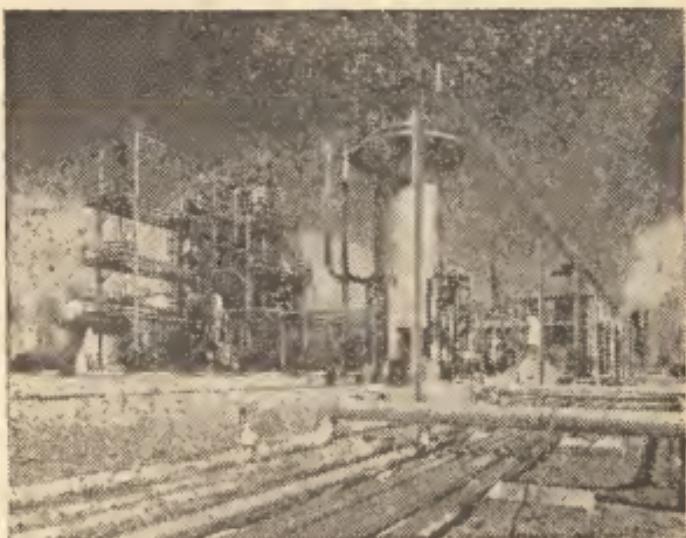
FUELS

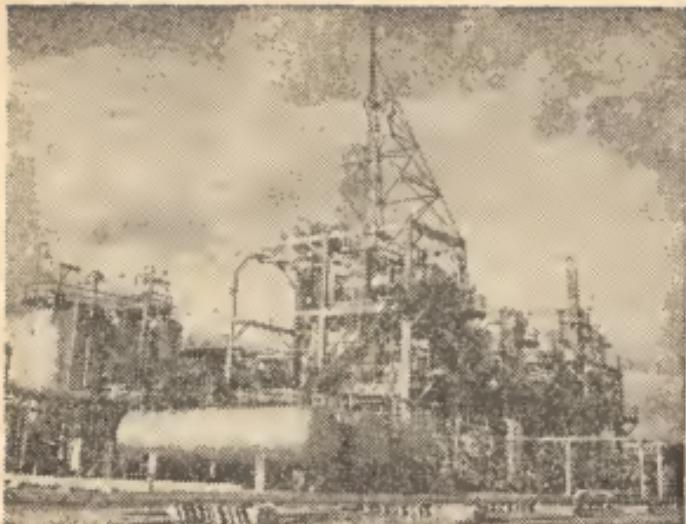
Of two small boys who were asked: "What is a fuel?" one replied: "Something that will burn." Whereupon the other remarked: "Diamonds burn. A fuel is something used for burning." It is not surprising that today the second boy is a research scientist with much original work to his credit.

"Something used for burning" is a definition of fuel on which, for accuracy and brevity, I will not attempt to improve. We must, however, be quite definite about what we mean by burning. What was actually happening

when things were burning was one of the problems that the early philosophers found beyond their understanding. Fire was in turn considered to be a devil, a living creature, a fluid and one of the basic elements of which many forms of matter were in part composed.

The phlogiston theory was the first scientifically sound approach towards explaining burning in terms of observed facts. It took into account the fact that when things burn they appear to diminish and phlogiston was conceived as a substance lost in the process of burning. Things which burned readily and left little ash were regarded as being very rich in phlogiston. It seems extraordinary that the intellects which had been able to show that the world was round, to plot the orbits of the planets, to develop algebra and Euclidian geometry and to circumnavigate the globe were never able to solve the riddle of fire. It is amazing that the medical philosophers who had discovered so much about our bodily processes should so long have left the question of why we breathe so completely unanswered. The weight of oxygen in the Earth's atmosphere, in





THE COMBUSTIBLE TWINS

The elements carbon and hydrogen are very plentiful in the Earth, but usually are found already combined with oxygen and, therefore, not combustible. However, the energy of solar radiation is used by living creatures to form compounds of carbon and hydrogen from which oxygen has been re-

the oceans and in the Earth's crust is roughly equal to the weight of all the other elements put together. Every schoolboy now is aware that burning is not the giving away of phlogiston but the adding on of oxygen.

Of the vast tonnage of the Earth's oxygen, only a very small amount is available for use in conjunction with fuels to produce fire. Almost the entire crust of the Earth consists of substances which have already been burned—they have already got their oxygen. The comparatively small quantity which is left to spare is very much weakened by being diluted with four times its volume of nitrogen.

Fuels, then, must necessarily be substances which have not already acquired their full share of oxygen. Such things, by being made to combine with oxygen, produce chemical heat which can be converted into the various other forms of energy that man requires, particularly the energy by which he transports himself and his goods from place to place. It would seem that it is fuel that is going to get man from world to world, and so a little thinking about fuel will not be out of place for readers of *Authentic*.

Photos: Esso Petroleum Co. Ltd.

removed. These substances have been our major source of fuel. Living trees provided the wood which gave man his first fires. He used the fat of animals in candles to obtain light. Later he learned to tap the stores of combustible carbon and hydrogen in coal, the buried remains of giant ferns and other flowerless plants from primeval swamps. Mineral oil is probably also a heritage of carbon and hydrogen from very early living things.

As man's use of fuel has extended, his needs have become more specialised. Wood and its derivative, charcoal, were good enough to cook his food and warm his dwelling places. Coal would raise steam for stationary engines, locomotives and steam ships. The development of the internal combustion engine required volatile oils and demanded fractionating columns and all the techniques of oil refining. The use of the internal combustion engine in aircraft engines increased the need for high octane fuels, i.e. for oils of boiling points within narrow limits with the right hydrogen to oxygen ratio in their composition and with adequate chemical energy available on combustion with oxygen. To meet these requirements new ways were

devised to produce molecules built up of properly organised atoms of carbon and hydrogen. Molecules which were already present in mineral oils were often too big. Cracking processes were evolved to break them down and cover their loose ends with hydrogen atoms.

Synthetic fuels have been produced in processes by which the appropriately shaped molecules have been built up from individual carbon and hydrogen atoms. The carbon used was in the form of coke and, therefore, was still obtained as a result of the activities of long dead early forms of life. The hydrogen, however, had been obtained from water and thus man was using his own methods of doing what had formerly been done by plants.

Modern industrial chemistry has made available at low cost oxygen gas which is not diluted by nitrogen. The oxy-acetylene flame is an established example of the effect of burning in oxygen instead of in air. The V-1 pilotless aircraft used a synthetic fuel more akin to methylated spirits than to petrol and depended for its propulsion upon high temperature of burning. It was found worthwhile to add considerably to the weight of the vessel by including compressed oxygen in spheres of intertwined strips of metal. In space, of course, we shall have to take our oxygen with us also. In space, too, we shall depend for our propulsion on discharge of gases. The more rapidly we can discharge them, the more power we shall get from a given weight of fuel, which makes it probable that the fuels we shall use will not be substances which are combustible in the ordinary sense of the word. So far most of man's fuels have depended upon the type of burning which involves the addition of oxygen to hydrogen to form water, and to carbon to form carbon dioxide, but there are others.

BREAKDOWN ENERGY

Nitro-glycerine, T.N.T., picric acid and nitro-anisole are examples of

compounds composed of fairly large molecules, each containing a few atoms of nitrogen and all of them ready to break up very rapidly, releasing large volumes of gas at high temperatures. For our purposes the rapidity of break down is too great. We want gases released at such a rate that, discharged from the tail of the vessel, they will push it forward, and these substances would merely shatter the ship into small pieces. T.N.T. is a very useful high explosive, but useless as a propellant fuel.

Of course it has to be detonated by the explosion of some other substance before it behaves so violently. Five hundredweight heaps of contaminated T.N.T. can be safely ignited in the open air, whereupon burning takes place quite slowly, a thick column of black smoke showing the combustion of the carbon in it is far from complete. It might be found possible to decompose high explosives at a controlled rate by a reaction which is partly a combustion with oxygen and partly a molecular disruption to get a rate of energy release which would make them suitable for rocket fuels.

There are, however, other nitrogen containing molecules which disrupt less violently. These form the basis of the so-called propellant powders which have long been used to eject missiles from gun barrels. Notable among them is nitro-cellulose. This has already been used for propelling missiles while actually in flight. Bomb-like projectiles were thrown from trench mortars with little tubes of propellant tied to their tails to augment the thrust given to them in their initial discharge. Japanese aircraft were equipped with cannon to fire heavy shells which also had a booster charge of propellant powder in their bases, the aircraft being spared the recoil strain involved in firing so heavy a missile by ordinary methods.

For the purpose of propulsion through space we shall certainly have

Continued on page 158

THE BOMB AND THE BLIZZARD

by JOY K. GOODWIN

AIN'T ITS HOCKIN', THE weather? Makes you wish you hadn't been born—and I'm *that* cold . . ."

"Yes, never was this bad when I was a kid. And we don't get the summers we used to . . . Look at last summer, nothing but clouds, and drizzle, drizzle, drizzle all day till you're sick of it. Reckon it's them scientists and their atom bombs. Lettin' 'em off all over the place . . ."

And so on, eternally. The "intelligentsia" scoff at the ideas of the man in the street, but . . . may there not be more than a little truth in the idea that the atomic explosions are affecting the British weather?

Let us examine the facts. For the last few years,

people have been complaining that the weather has deteriorated, and last summer with its continuous drizzle was the final blow. This past winter, with a temperature in Scotland reputed to be the lowest ever recorded; with men dying of exposure in the enormous drifts of snow brought by the blizzards of February, seems to confirm the fact that the weather is worse than we have previously known.

Yet the Meteorological Office has quoted the year 1903 as a similarly bad year, and point out that atom bombs were unknown in those days.

An atomic explosion, besides the tremendous effects of the heat flash and the gamma rays, blows into the

upper atmosphere vast amounts of dust—radioactive and virulent. Most explosions are made in desert areas—New Mexico is a good example. Others are exploded on islands formed of corals, where the sea and weather grind down the coral formations to a powdery sand—Eniwetok, Bikini, Monte Bello.

This sand is funnelled up to the atmosphere in the swift inrush of air which takes the place of that forced outwards by the blast. Through the mushroom, the sand and dust belches upwards and distributes itself through the upper layers of air, circling the globe, swept hither and thither on the currents until it sinks in the fall-out.

But the bombs are exploded thousands of miles away from Britain . . . Yes, and most of Britain's weather is affected by the airstreams, the cyclones and anti-cyclones that come from the West—from the direction of America. And from that direction, too, come the soaring clouds of dust,

travelling in an atmosphere of bitter cold.

If you fill a glass with cold water, then stand it in a steam-filled kitchen, within a few moments it is covered with a film of moisture. So, as the cold dust falls through the clouds, the vapour condenses on each particle. As more and more water condenses, the particles become too heavy to stay up, then fall, perhaps as rain—the slow miserable drizzle of summer 1954, perhaps in the snows of February, 1955.

Yet, atom bombs were not exploded in 1903. Was there, however, a large amount of dust in the atmosphere?

In historical record can be found the following:—Mont Pelee explodes 8th May, 1902, after having started erupting on 20th April. Again, Mont Pelee—with its sister volcano, La Soufriere, 90 miles to the southward—erupts on the 3rd September, 1902, in evil counterpoint, one answering the other. The most violent eruption of Kilauea, Hawaii,

for twenty years, started on the 10th November, 1902. Santa Maria, Guatemala, October 26th. Savii in Samoa, 13th to 30th October. Windward Islands . . . Mt. Chullapata in Peru . . . lava-dust and ashes, flung into the air, swinging around the world in a layer of cold winds.

Dust in 1903? Charles Fort comments: "On the 12th of November"—1902—"upon all Australia, except Queensland, dust and mud fell from the sky."

All this dust could not disperse within a few days. The dust from Krakatoa's explosion lasted for several years, causing the most brilliant sunsets. What then, when half a dozen volcanoes are blasting the air with their belching ashes?

We see from this, then, that the atmosphere of 1903 did contain large amounts of dust. The weather of 1903 was some of the worst in recorded history. Atomic explosions in the years since the war have increased until

they are now a common happening, mentioned only in some obscure paragraph of an evening newspaper, not even worthy of the front page . . . dust, floating round the world in an icy cloak.

Fifty years later, in 1953, during the months of March to June, atomic test explosions were made in America on the following dates: March 17th, 23rd; April 1st, 5th, 7th, 12th, 18th, 25th; May 8th; June 5th. The New York Times Index gives an extremely interesting summary of tornadoes occurring in the eastern states of America—a most unusual area for tornadoes—approximately ten days after each explosion, while during those months other abnormal weather was also experienced.

For instance, the March rainfall was 7.91 inches—an all-time high, and New York City's April rainfall was 2.77 inches above the normal (usually 3.22 inches). Their Weather Bureau reported that the January to April precipita-

tion set a sixty-year record. On April 15th, the New England States recorded the highest amount of snowfall since 1888, a whole foot.

June 9th: Cleveland, Ohio, had its first tornado for twenty-nine years and in all Michigan and Ohio had eight tornadoes. On June 10th, Worcester, Massachusetts, had its worst tornado for *seventy-five years*, with 2,500 people left homeless. Giant hailstones hit Steuben County area, while New Hampshire's town of Exeter was heavily damaged in a severe storm. In these, and other, tornadoes occurring between March 20th and June 10th, 1953, 326 people were killed, thousands injured, and nearly one hundred million dollars' worth of damage was suffered.

These are facts recorded by a reliable Bureau—that the radioactive dust is blown into

the air and circles the earth is also a fact. May there not be some connection?

Many years ago, country people believed in the efficacy of spiders' webs and mouldy bread for healing wounds. Only recently was the discovery of penicillin and similar antibiotics disclosed to the public. The warm laughter of the country was smug at the thought of Officialdom not knowing that they had been used—albeit without the reason being known—for hundreds of years previous to the discovery.

Perhaps, a Board of Inquiry will eventually be set up in Britain to correlate all known facts of the effects of atomic explosions upon the weather.

Till then, those who "know" will say "Nonsense," while the man in the street says "It's those damned bombs!"

BERYLLIUM

by W. W. BYFORD, B.Sc.

THE BERYL HAS LONG BEEN KNOWN as a gem stone. A beryl is a silicate of aluminium and beryllium (both aluminium and beryllium being metals unknown before the age of electric power) and today most of the beryllium metal obtained by man has been separated from beryl. This does not mean that millions of gemstones have had to be destroyed. The metal was first extracted about 1827 and then only as a powder. Beryllium in massive form such as we commonly accept a metal, was not obtained until the last year of the nineteenth century. Why all the delay? It takes high temperature and air exclusion to do it. An alloy known as beryllium copper was obtained by heating beryllium oxide with carbon and copper in an electric arc furnace. The difficulties of obtaining and working the metal even after its successful extraction prevented it from being of industrial use until midway between the first and second world wars.

In the beginning of this century, beryllium looked like being the miracle metal. It is very light; volume for volume aluminium weighs half as much again. It is strong and has a high modulus of elasticity. The melting point is much higher than those of other light metals. Aluminium and magnesium both melt at about six hundred and fifty degrees Centigrade. Beryllium has a melting point above twelve hundred degrees Centigrade. Beryllium resists atmospheric corrosion.

This combination of desirable properties gave rise between the two world wars to the belief that in beryllium we had the answer to many of the problems that industrial development was setting the scientist. Aircraft hulls could be made with beryllium, re-

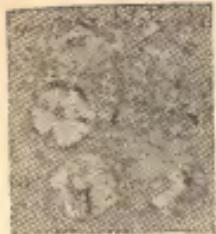
placing magnesium aluminium alloys, that would be much lighter and stronger and more durable. Beryllium pistons were a possibility. The metal available in sufficient quantity would make possible entirely new structural designs for large buildings and bridges. Small gadgets of many purposes could similarly be made of so strong and light a metal.



When parts must function repeatedly without fail, aircraft designers specify beryllium copper, the unique alloy with a multitude of desirable properties. This Lockheed Constellation serves to show where beryllium copper parts can be found in many modern airliners. For parts, see below.



These Berylico parts—a few of those used in modern planes—are numbered to indicate where they appear in the large photograph.
1. Propeller bolts; 2, fuel injector; 3, de-icing stud; 4, instrument switch part; 5, instrument diaphragm; 6, connector, plug type for coaxial; 7, safety belt release.



We expect the motor to roar when we push the starter, the wipers to swish away the rain, the heater to pour out warmth. Berylco parts make this possible. For parts and key numbers, see illustration on the left.

Shown here are the Berylco parts numbered in the car on the right—a few of the many which help deliver top performance. Reading across, they are: 1, wire clips; 2, dimmer switch terminals; 3, antenna raiser; 4, windshield wiper springs; 5, cigar lighter contact; 6, heater control; 7, door switch spring.



Now it is very pleasant to be able to write flowing accounts of scientific projects that have gone on to glorious achievements, and very often when we do so we can be magnificently, even if fallaciously, wise after the event. This time, however, we have the much less exhilarating job of telling why most of these great intentions for beryllium have not yet been carried out.

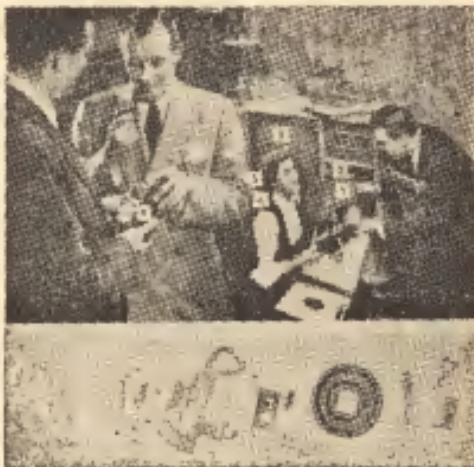
Firstly, the ideas got around a bit too soon and were probably overstated. People who had any beryl under their authority already thought of it as a valuable gem-stone and now began to think that they really had something to sell dearly. At one time or another in one way or another, the beryllium ores have been a thing to keep rather than sell. Prohibitions or prohibitive restrictions have been put upon the exportation of the ore from India, Madagascar and the Argentine. The big build-up that the metal had been given by research into its properties made the price rise in such a way that it tended to remain in the research laboratory rather than proceed to the factory.

Another reason why the cost of beryllium remained high was the dif-

ficulty of extraction from the ore. It is because it was difficult to separate from the aluminium and the silicate in beryl that beryllium oxide was so long unknown to man. It took another thirty-five years to discover how to separate the metal from the oxide—then another seventy years passed before the metal was obtained in

such condition as to look like a metal. It seems that we have still not found a method by which it is possible to get large quantities in adequate purity. The

Beryllium copper makes sensitive gramophone needles, sturdy record changer parts, reliable TV sets. This home entertainment centre illustrates the wide use made of versatile Berylco. For parts and key numbers, see below.



These Berylco parts—a few of those used in the home entertainment field—are in the order in which they appear in the large photograph above: 1, gramophone needles; 2, record changer knife; 3, TV tuner clip; 4 camera baffle; 5, tube socket contact; 6, tuner clips.

kind that is made still leaves us in doubt. It is difficult even to get enough pure beryllium to investigate its strength properly, and such as has been made, has been found unworkable by cold methods. Small quantities of thin sheet metal have been produced by hot working, but with such a high melting point, hot working of beryllium is really hot, difficult and expensive.

Lastly, another serious snag about beryllium. It began to be used for lining fluorescent lighting tubes. People got sick—very sick. Very fine dust of beryllium, or certain of its compounds, does unpleasant things to the lungs. Thus elaborate precautions have to be taken wherever the metal or its oxide or carbide are being handled. Thus, against extensive use of beryllium in large quantities, we have limited amount of ore and restricted access to what there is. Prospected new sources have not been found. The cost of production of the metal is high. The metal is difficult to work and has toxic properties. And so, for the time being at least, some of the earlier dreams of glory for beryllium are only dreams.

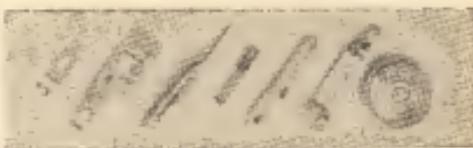
The figures for the consumption of the mineral known as beryl tell the story of beryllium to date quite effectively, but in thinking about them, remember that one ton of beryl contains only one hundredweight of beryllium.

In 1937 the consumption of beryl was 150 tons. In 1943 the consumption was 3,000 tons. From then until 1946, it steadily dropped, but has since slowly risen again and is now possibly in the neighbourhood of 4,000 tons.

The consumption figures show clearly that beryllium cannot be written off as useless, although, compared with what some people had anticipated, its uses are insignificant. If we think in terms of quantities insignificant is the word—if we consider the nature of the



Because they are necessary to our way of life, people take appliances for granted. They expect them to work without constant adjustment or repair, and to last many years. That's why you'll find beryllium copper used in vital assemblies of most appliances today. For parts and key numbers see below.



Berylico parts and where they function in the modern kitchen can be seen by locating the corresponding number in the large photograph above. The parts shown are: 1, temperature control; 2, oven control; 3, timer part; 4, brush spring; 5, overload relay; 6, toaster spring; 7, contact springs.

purposes now served by the metal, we find they are not without interest.

Thin sheet beryllium is very easily penetrated by X-rays and can, therefore, be used for making windows in X-ray tubes and is, in fact, widely used for that purpose. Beryllium oxide does not break up on heating, nor is it easily persuaded to give up its oxygen by chemical means. Further, it has a very high melting point, over two thousand five hundred degrees Centigrade. These properties put it in the class of substances which we call refractories. The oldest of such substances in common use is the oxide of

Continued on page 158

The Physiologist

by JOHN TAYNE

PYSIOLOGY IS THE RATHER high-sounding name for one of the most interesting of all sciences—it is the study of the functioning of the normal animal, usually man himself. Leonardo da Vinci was one of the first physiologists; we have come a long way since his time, but there are many aspects of body function that we do not fully understand. Physiologists thought that they knew how our food is digested, how our blood is circulated, how we lose heat when we are hot, how blood clots, how we lose or gain weight, how we breathe—they can certainly explain these processes to a certain level, but more advanced techniques tend to show up complications. We once thought that there were three digestive enzymes in our intestine—now we know there are about eight and there may

be more. Science progresses by this sort of analysis. We can accept the fact that an enzyme in our saliva breaks down starch into sugar, but in order fully to understand this reaction we have to know a lot about the intermediate products and sometimes these can be very complicated indeed.

Like all other scientists, the physiologist often goes outside the arbitrary "boundaries" of his own science to solve some particular problem. Physiology is often inextricably mixed with psychology in problems about the brain; with pharmacology in drug research. It is part of the knowledge of every medical doctor and of every pathologist (pathology is the study of the *abnormal* animal—every hospital has its pathologist). Physics, chemistry, botany and zoology are all sciences

sometimes useful to the physiologist in his work—it is impossible for a scientist to restrict himself to just one science. A few of the physiologists working on the fringe of their science are: the biochemist (he works on the chemistry of living matter), the nuclear physiologist (he notes the effects of electron streams on viruses), the cytologist (who works on living cells), and the mathematical physiologist (who is concerned with the statistical side of the science).

As in the other sciences we have dealt with, we have both pure and applied physiologists and here are some of the more important topics they are currently working on. They tend to be working on whole systems rather than on separate organs or tissues, as this gives a more general view of how the body functions.

Research on endocrine glands (ductless glands like the thyroid) is divided broadly into two main lines. One line is trying to establish what external changes modify the action of the system. It is known that the pituitary gland governs most or all of the other ductless glands, but physiologists are not yet sure

what governs the pituitary. It is highly likely that the pituitary is governed by the brain, and this line of research traces the path of an external stimulus (such as light) through the brain to the pituitary and then to the other glands. The other line of endocrine research, and one involving a great many of the world's best physiologists, is concerned with the role of the outer part of the adrenal gland. It has been known for a long time that this tissue controls the level of salts in the blood and plays a part in glucose metabolism. Very recently it has been discovered that this tissue is concerned with more subtle things, such as response to emotional stress.

The nervous system always comes in for a lot of study because it is of such great importance in the life of the animal. Current nervous research is largely concerned with pinning down the function of the cerebral cortex and with analysing the mechanism of its mastery over the rest of the nervous system. Here we find a new specialist—the electroencephalographer—the person who studies the correlation between electrical and

mental activity in the brain. Results of this recent nervous research have proved most fruitful in the treatment of many nervous diseases which, hitherto, have been intractable.

A fair amount of work is being done on digestion and nutrition. Everyone knows how a new vitamin turns up every few years! Biochemists are constantly discovering new digestive enzymes. Another line of work in this field is the elucidation of chemical reactions by which the compounds in the food we eat are converted in the body either to tissue or to energy. This work has had a tremendous impetus from the recent availability of radioactive isotopes. These compounds enable the physiologist to "label" a foodstuff and subsequently trace it by this "label" right through the body—hence the name "tracers."

Now we come to the applied physiologist whose task can be summed up as trying to find the conditions under which normal bodies can function more efficiently and with less risk of becoming abnormal under unnatural conditions.

We have the industrial physiologist who investigates

conditions such as lighting, heating, etc., in factories so that the operators will be as efficient as possible. He will estimate the minimum number of cubic feet of air that each worker needs, so a limit will be put on the number of people working in each factory room. Diet will also come into his consideration—some workers in hot surroundings are given salt tablets; some metal workers have an allocation of milk. He will always be on the lookout to cut down factory hazards such as solvent vapours or harmful dusts.

When you hear of an experiment that is undertaken to test living conditions in snow, desert, sea or some such unlikely place, you may be sure a physiologist has taken a major part in designing it. He will examine the volunteers while the experiment is on, when it is over and perhaps for long after that—he may even be a volunteer himself. The effect of several different types of equipment is tested on these expeditions: tents and clothing, food tablets and canned food, oxygen apparatus, the effect of salt water, sunlight, heat and cold; all these and many more

come in for close examination. Physiological investigations formed a large, though not much talked-about, part of the Everest expeditions and a fair amount of it was done on the Kon-Tiki journey.

We have already mentioned the nutritional side of the subject, but there is an aspect of nutrition studies which could be said to be applied and that is performing actual diet experiments on people. Volunteers, while on a vitamin C-free diet, were scratched at intervals and their healing times noted. Other, rather less formidable, experiments have been done on groups of children—one recent experiment set out to test the values of wholemeal and white bread in the diet and another to determine the effect of extra sugar in the diet, on tooth decay. These experiments are invaluable—a foodstuff may have the most wonderful constituents when analysed in the laboratory, but only by experiment can we determine whether or not the body can

utilise it. Somewhat along the same lines was an amusing experiment carried out in America not long ago. The idea was to see whether young children, left to themselves, would instinctively select theoretically suitable diets. The children were supplied with any amount of a wide range of eatables for several weeks—including unlimited sweets, ice-cream and fancy cakes. Within a day or two the children settled down to a perfectly nutritious—and quite unbilious—regimen. Thus applied physiology was able to modify certain parental prejudices!

One other branch of applied physiology is that concerned with military matters. All large air forces have their physiologists, studying problems such as the effects of acceleration, depressurisation, and fatigue—often miscalled “aviation medicine.” In America they even have an autonomous Department of *Space Medicine* attached to Randolph Field, Texas.

The way to the Planets

by A. E. ROY, B.Sc., Ph.D., F.R.A.S., F.B.I.S.

3—*The Satellite Vehicles*

MANY PEOPLE THINK OF the idea of an artificial satellite to the Earth as a very recently conceived one, but that is not so. As long ago as 1870, E. E. Hale wrote a story entitled "The Brick Moon," concerning a group of men who, deciding that it would be an aid to navigation if Earth had a second moon, decided to build one. Quite recently, Dr. Sadler, of Her Majesty's Nautical Almanac Office, in an address to the Royal Astronomical Society, also pointed out that an artificial satellite would be useful in this way.

But the first person to study the possibilities of a space station was the Austrian, Captain Potocnic. He published an entire book on the subject in the '20's under his pen-name Hermann Noordung. Count von Pirquet, another enthusiastic student of astronautics, also recognised the importance of the idea. He had pointed out that

the dream of space travel from the surface of the Earth to the surface of another planet and back by one ship using chemical fuels could be dropped as impracticable. The initial mass required, even with the most optimistic fuel velocities, runs into hundreds of thousands of tons. But Pirquet saw that the space station—the terminal in space—could be used to refuel spaceships on their way to the planets. Nowadays we go even further—we believe that in the space station's orbit, special orbit-to-orbit vehicles (the true "spaceship" that would never land on any planet, being left in a circular orbit at both ends of the trip) will be constructed and fuelled there.

At the 500 mile height, the station would have a velocity relative to the Earth of about 5 miles a second, circling the Earth in two hours so that that velocity, compared with the Earth's orbital velocity of $18\frac{1}{2}$ miles per second, would

be added on to or subtracted from the Earth's velocity according to the space station's position. Thus a spaceship, built near the station, could have at the outset a velocity of $23\frac{1}{2}$ or $13\frac{1}{2}$ miles per second relative to the Sun, before it even began to use its rocket motors. Indeed, it would require only an additional $1\frac{1}{2}$ to $2\frac{1}{2}$ miles per second to break completely away from the Earth and travel outwards to Mars or inwards to Venus.

So we see that even from the point of view of manœuvrability, and the fact that the spaceship does not require powerful motors since it never has to fight its way upwards against the Earth's gravitational field, the space station is an essential first step in the conquest of space.

Even if the space station was the only step taken, its construction would be worthwhile as we shall see later, but at present let us look more closely at the probable programme for its establishment.

Professor von Braun stated at the Second Symposium on Space Travel, held at the Hayden Planetarium, that ten to fifteen years from now, depending on how determinedly and efficiently we

tackle the problem, the Earth could have a second satellite, a man-made moon circling our planet at an altitude of 1,075 miles in two hours. The station, according to von Braun's design, would have the shape of a huge wheel—all those who have seen the George Pal film, "The Conquest of Space," will have the design fixed in their minds. About 250 feet in diameter, this great doughnut will rotate slowly about a central hub with its 80 to 100 scientists, technicians and other crew members living in the rim.

At the Hayden Planetarium Symposium, Professor von Braun laid down the logical steps he believes should be taken to establish this fantastic laboratory in space. He pointed out that as the station parts and fuel have to be hauled up to the orbit by flights of three-stage satellite vehicles, we must start with the development of such craft. He does not share the optimism of many rocket experts today who believe that space-flight will be the automatic result of all the efforts at present concentrated on the development of guided missiles and supersonic airplanes.

According to him, it requires a well co-ordinated programme extending over many years, each step leading on to the next.

His first step is the setting-up of study groups to do research into such problems as the development of suitable rocket motors, the manufacture, shipping and storing of the vast amounts of propellants required, the training of crews, and to study exhaustively the medical, radiological, biological and similar aspects of space flight.

The sequence of steps after the first is as follows. Variations in the design of rocket-planes flying today will give us the third-stage of our satellite vehicle, the stage that, after dumping its cargo of materials in the orbit, will spiral down to Earth again, using the atmosphere to brake it. Meanwhile, the second stage could be designed, built and ground-tested. As soon as it had been proved efficient, it would be flight-tested with a dummy third stage as payload to see whether separation of dummy and parachute recovery of the empty second stage was feasible. Only then would the second stage be used to boost the manned

third stage to higher speeds. In a similar manner, the mighty first stage, the one designed to carry the second and third on its shoulders, would be brought into being. Von Braun points out that as its power plant is simply a great number of small individual rocket motors set in mosaic design at its base, the rocket motors, fuel pumps and valves could be of the same design as those in the upper stages, thus cutting the cost of the satellite vehicle considerably.

After this development and testing programme has been completed, the three-stage ship would be ready for its first manned flight into the orbit.

While all this has been going on, plans of the space station itself, down to the minutest detail, will have been completed. These plans will doubtless have been continually modified as more and more information about the essentials for human comfort in interplanetary space have come in, from the unmanned orbital rockets previously set in circular orbits and the manned rocket-planes sent higher and higher into the Earth's atmosphere.

In Dr. von Braun's Mars

Project, the three-stage satellite vehicles designed by him to take material and parts up to the circum-Earth orbit have payloads of 39 tons. The total ship weighs 6,400 tons of which 5,583 tons are propellants. The first stage raises the velocity of the second and third to 1.5 miles per second before, its fuel exhausted, it falls away 84 seconds after the take-off. The second stage then fires for 124 seconds, raising the velocity of the third stage to 4 miles per second before it, too, falls away as the third stage fires. After an additional 73 seconds of firing, the third stage's velocity is built up to 5.2 miles per second, sufficient to keep it in a circular orbit about the Earth. The pay-load is now ejected and, by firing the motor in the direction of flight, the rocket's velocity is diminished to enable it to spiral back down into the atmosphere, where it glides home with the help of its wings. The first and second stages, now empty shells, would have been recovered by combined steel-mesh parachutes and rocket landing mechanisms, to be used again.

This design may seem to many engineers far-fetched, the idea of a ship of over

6,000 tons weight taking off vertically being too much to swallow. It must be remembered, however, that Professor von Braun is one of the world's foremost rocket experts. But in any case, von Braun's design of a satellite vehicle is not the only solution to the problem. K. W. Gatland, A. M. Kunesch and A. E. Dixon, of the British Interplanetary Society, have designed a satellite vehicle with an initial weight of 500 tons. The pay-load (propellant or material) is 5 tons, small compared to the 39 ton pay-load of von Braun's design, but it is felt that a 500 ton ship is a much more practical proposition than a 6,000 ton one.

The B.I.S. orbital vehicle, like von Braun's, is designed for construction on a production basis but with no attempt to recover more than the first stage for re-use. The reason it has a more favourable over-all mass-ratio (the ratio of pay-load to total initial weight) is that it has been designed as an expendable-tank rocket. What we mean by an expendable-tank rocket is this. Von Braun's three-stage satellite vehicle is an example of the conventional step-rocket where each stage

has its own rocket motor. Until the first stage has ceased firing and has dropped off, the motors of the second and third stages are so much dead weight, and part of the first stage's fuel must be used to raise that dead weight until it is required.

In an expendable-tank rocket, in theory, there is only one motor supplied with propellants from a number of tanks in turn. As each tank is exhausted of fuel it drops off until the life-compartment and motor remains. In practice, of course, the picture is not so simple and the Gatland-Kunesch-Dixon three-stage satellite vehicle combines some of the features of both expendable-tank rockets and conventional step-rockets.

The first stage (the booster) is of conventional design with its own mosaic of rocket motors and is designed to be "returned when empty." The second stage uses expendable construction to give four propellant tank bays, three of which are jettisoned as they are emptied, and has a central sleeve with a detachable nose, into which is fitted the third stage.

We have said nothing so far about suitable launching sites for such vehicles. In

selecting a site, many factors must be borne in mind. We must provide a distance greater than the expendable tanks and empty stages will travel before reaching their points of impact. The site should be easily reached by sea or rail since large quantities of material must reach it. In order to obtain the benefit of the Earth's rotational speed (1,000 miles an hour at the Equator) the site should be there. It should also be possible to reach and tow back the jettisoned stages.

Gatland, Kunesch and Dixon have suggested island launching sites in the Pacific, particularly on the Christmas Island group where we have some 4,500 miles of ocean extending to the Galapagos Islands. The drawback here is the large distances materials would be required to be shipped. They also suggest a site on the East African coast in Kenya giving an adequate firing lane across the Indian Ocean to Indonesia. Unfortunately, this site has a dropping area that straddles a number of shipping routes. Finally, they suggest sites in Brazil, on or near the Equator, with a clear stretch of the South Atlantic in which to drop tanks and stages.

SAUCE FOR THE GOOSE

by R. THOMSON



TV set last year, instead of the annual vacation on the coast. But many times the parents had regretted giving in to the children.

As Mary had said so many times to her husband: "Bill, those children need a change of air. They're looking peaky."

Bill had to agree. They were looking peaky and that wasn't right for his kids—no sir—not for his kids it wasn't!

The parents had a few doubts about leaving the newly installed hydrogen-bomb shelter for so long. But as Bill philosophically asserted to Mary: "It ain't no use gettin' morbid. If we're gonna get blown to bits, as well do it at the sea, I reckon!"

But they never reached the sea, nor did anyone ever finish what they were doing prior to 11.34 on that mid-summer day, nor did anyone ever awake, who had been sleeping, because at that hour the whole planet system and a few thousand quadrillion other galaxies ceased to exist.

BILL AND HIS WIFE WERE GOING to the sea with the three children. They were going to have a fine time. It was to be their first holiday for two years, as the kids had voted for a



Old Professor Smith was giving his last lecture. He was retiring as senior physics professor at the end of the term, and it was something of a custom at the university that a professor's last lecture should be a trifle revolutionary, and was not to be taken too seriously.

The professor was not one to break with convention . . .

" . . . and so, gentlemen, I shall conclude by suggesting to you the possibility that, with the discovery of sub-sub-sub atomic particles increasing every day, these so-called "particles" are, in fact, miniature worlds—probably inhabited."

With a twinkle in his eye, he waited for the laughter to die away before continuing.

"This is not a laughing matter—why! for all we know the particle known as the atom might constitute a cosmos to the dwellers who inhabit its millions of worlds. At this very moment they might be in an uproar over an impending hydrogen bomb detonation, as we are!"

The laughter was tumultuous. He held up his hand for silence.

"Yes, I see you grasp my meaning. If these creatures are themselves studying nuclear physics . . . well, rather than offend any of you by reviving the discarded theory of the continuous divisibility of matter, I'll leave that sentence in the air!"

He again motioned for silence, but

it took a few minutes to restore. His pupils were too proud of the "old man's" audacity.

Professor Smith picked up a test-tube from a rack before him.

"In this test-tube is about a gram of sodium chloride—common salt. It has undergone a process of purification, but nothing has as yet occurred to disturb its infra-atomic structure. All the gross physical changes it has experienced would be inconceivable and could not affect the denizens of the inner worlds."

In his other hand he took a beaker containing a little water and poured its contents into the test-tube. He and his rapt audience watched the process of dissolution till it had ended.

The professor proclaimed solemnly: "Mine may be the hand that has brought about the destruction of a billion billion intelligent peoples."

Again the students laughed. But Bill and Mary, who formed only a very small portion of one such people were no longer in a position to laugh.

The professor wound up his successful swan song with a remark which brought the house down.

"My good students, our own cosmos may be one atom in the rear knee-cap of a bug which has been giving hell to some poor hound. God help us if that bug ever lands up in the dog's belly!"

Peter and Alice were newly-weds on their honeymoon. It was their first morning together at the hotel. She had just poured their coffee. "One lump, or two, dear?" she enquired.

Immediately the words were uttered she clasped her hand to her mouth. But it was too late. The elderly couple at the next table turned toward them and smiled. Alice blushed, and Peter, just to show how proud he was of his new spouse, kissed her there and then. "Two lumps, darling."

In went the second lump, and Peter began to stir it until he could no longer feel it with his spoon.

This time nobody laughed. Professor Smith had been wrong about that bug . . .

The Electron-Telescope

ASTRONOMERS ADMIT THAT the limit in size of telescopes has been reached. Even if the money could be found, even if the problems could be solved to build greater telescopes, their use would be severely limited by the erratic fluctuations of the air under which we live. It is this air, for example, that prevents photographs being taken that would solve the problem of the "canals" of Mars. Even in the largest telescopes, to obtain an image of the planet bright enough to photograph, it must be made tiny. Even then, a time exposure must be made and during that time, the oscillations in the Earth's atmosphere cause the image to quiver on the plate, destroying the fine details due to the canals.

For example, Dr. A. Lallemand of the Observatory of Paris recently referred to their use of an image converter, in which the image produced on a photocathode by a telescope is focused by annular discs maintained at very high voltages to give finally an electronic image. This electron-

telescope has been used to take photographs of astronomical objects with greatly reduced exposure times. In the case of Saturn the exposure time is about one-twentieth to one-fiftieth the usual time.

Again, at John Hopkins, in America, work has been going on along similar lines based on the image-orthicon tube used in TV cameras. And at Lowell Observatory, built primarily so many years ago to study the faint detail of Mars, the electron-telescope was used last summer when the planet was almost at its closest approach to Earth. Even although seeing conditions were by no means good, and though the astronomers were using only a 24-inch telescope, they obtained photographs almost as good as the best ever taken.

Next year Mars will make its closest approach to Earth for about seventeen years and it is hoped that then, using the new telescope, a solution once and for all will be obtained of the seventy-year-old problem —are there or are there not canals on Mars? A.E.R.

New people came and an old life changed
when the scientist said—

Let there be rain

by JONATHAN BURKE

NOBODY WOULD EVER have called the place beautiful, and he had never thought of it that way; but now he was indignant because of what they proposed to do to it. Thirty years he had been here, and he had got used to it the way it was. Now everything was going to be altered. They had caught up with him. They had invaded his silence, his blessed loneliness, with their machines and their charts, their eyes greedy and remorseless as they raked the sky and the desert.

He sat in the porch with his helmet off, breathing lightly, letting the pleasant dizziness of the evening come over him. He gazed down the slope to the parched land below.

They said it wasn't going to be parched any longer.

The four towers stood at the corners of a great square. They were raw and ugly, great spindly monsters jutting up from the hot monotone of the sand—the red sand which had burned his eyes and blown into his house and insinuated itself through his clothes for so many years now that he had grown to love it. Familiarity with this harsh wilderness bred love.

Strange patterns of metal track and cable disfigured the square. Unknown metallic fingers probed down into the sand—devices beyond his comprehension. A litter of hutments straggled along the foot of the hill.

There would have been tears of vexation in the old man's eyes if he had been capable of tears, and if all the moisture had not been wrung

out of him on this dry world. He had not cried since he was a child. Not even when his wife died. He had left a world he hated and faced a world that was hostile to man, and all the time his lips had been tight, his eyes cold. His wife killed in a senseless war, killed in that damp, miserable northern city, he had renounced that planet and begun to wrest a living from this place without memories. Here there had been no traditions and no echoes to disturb him. The dead wastes were soothing; the rocky hillside was a challenge he was glad to accept; the thin, gritty atmosphere was invigorating.

Out in the open, working on the hillside, he wore an oxygen helmet. It was one of the old fashioned ones—the helmet of a pioneer, without radio, without ear resonators; simply a good old serviceable helmet for which the small atmospheric generator in the lee of the house worked day and night. Inside the perslite dome, the old man was secure

and alone. He heard nothing . . . and what would he have wanted, or expected, to hear? Only the shuddering sound of his tools against the rock, his feet scrabbling up the slope—sound conveyed through his bones to his head.

That was enough. He was content that he should be cut off in that way.

His shack, soundly constructed and sheltered in its hollow on the hillside, lay in one of the characteristic air pockets. In these recesses it seemed that the planet breathed, letting out little gulps of air, gently panting under the hot sun. Here you could sit without a helmet, and even move about, provided you did nothing too strenuous. Here, in the evenings, you could sit and dream.

No, not dream. Not that. Here, rather, you could sit and think, making plans for the work to be done on that field of boulders, working out a way of getting the fine mineral for the generator up here with a little less exertion.

Gradually the old man had come, without realising it, to believe that the landscape below his home was beautiful. Because he had lived with it so long and grown to know its moods—they were few enough—it became lovely in his eyes. Shading those bleak grey eyes of his against the ruthless sun, he would peer out in the early morning or late afternoon across the expanse of desert, right to its clear edges along the horizon, and he would feel uplifted. If there had been a wind the distances would have been hazed with dust; but there was really not much likelihood of a wind in this quarter of the planet. Over near the old spaceport, where he had landed all those years ago, there had been winds. But here there was little disturbance. Here there was stillness.

He shed no tears of nostalgia for that other world he had known, and no tears of happiness for this—he just nodded, and approved of it, and found it satisfying.

When he thought of that old world he thought of the interminable winter rains; of those days when the roofs dripped moisture into the streets, the gutters chattered incessantly, and patches of damp showed like shadows on the ceiling of his home. He thought—only infrequently, when he was tired and memories asserted themselves against his will—of his wife, and that cough of hers . . . But he could usually drive that out of his mind. The echo of her painful cough and the last echoes of that bomb which had killed her but left him alive had been driven out, and rarely returned—driven out by the sound of his pick striking rock, the impact shuddering up through his bones and into his head.

Here there was no rain. Here no other human voice disturbed or reproached him.

But now the huts down there were growing in number. Ships fell avidly from the sky in a splutter of dust and flame. He damned each and

every one of them, cursing as they came, spitting abuse at them from his farmhouse on the hill.

A few days ago a man in a white uniform had been up to see him. Very smart he looked, and young, and well pleased with himself and what he represented.

His lips had moved within his helmet, but no sound reached the old man. The newcomer tapped a small black attachment close to his throat. The old man shook his head.

At last their helmets touched, at a point above the ears, and now the voice resonated.

"You mean to say you've still got one of these old things?"

It was such an obvious remark it did not merit an answer.

"You mean if you want to talk to anyone, you still have to use this clumsy old method?"

"Who would I want to talk to?"

The young man grinned. "One of the pioneers, eh, grandad?"

"I been here a long time." He used words slowly and parsimoniously, having got out of the habit of talking aloud except in a meaningless mumble when he was working.

The other, with his bright smile and the dazzle of his sleek uniform, sketched a gesture towards the encampment below.

"That should make some difference to you. Better late than never, eh?"

He didn't know, didn't understand. Only hated. He said: "I've no idea."

"We're going to bring rain here. Rain. Didn't anybody tell you?"

"No." Who would have told him?

"Well, I'll be damned. Didn't you ask yourself what all that was for, down there? We've been here some weeks —didn't you get round to thinking about it?"

He had not asked, had not thought; only hated.

Now he said from the depths of his aloneness: "Rain? Who wants rain?"

The young man laughed incredulously. Once more his arm moved, sweeping in an arc to take in the whole horizon and the hills. One might have thought him the creator and co-ordinator of all that lay within sight.

The movement had carried him away from the old man. His lips moved again, but now there was silence. Impatiently he gestured towards the house, and the two of them went and stood in the hollow and removed their helmets.

"Take it easy," said the old man. "You're liable to get dizzy spells until you settle down to it. Don't get yourself fussed."

Again the declamatory wave. "Look at it. Just look at it—and you ask who wants rain. I'd have thought you'd have been the first to go down on your knees and thank us. In five years at most, all this'll be fertile land. The

great change is coming, old-timer."

"And people. They'll be coming, too."

"Sure. The place'll be fit for development at last. The families of the men down there will be here in six months at the outside."

"Lots of people."

There would be men and their families and their homes and their jobs and their troubles. Human beings carrying their troubles and agonies with them like a disease. Men and women, populating this beautiful wilderness. And rain. There had been no rain in the old man's life since those grey days in that remembered city.

No, not remembered. Forgotten. He would forget.

The young man from the four-towered encampment had laughed and slapped him on the back and gone away, and now to instinctive hatred was added the knowledge of what was to come. The echoes were awakened, and in the dark reverberant depths of

his mind he heard the dismal patter of rain against windows. On and on it went, as it had always done. There had been no sunshine in his youth; none that he remembered.

And now it was to fall here, too. The thin brackish streams which trickled down once a year from the polar regions were not enough. Man was greedy and acquisitive. Man came here with his theories and ambitions and machines, and the desert would be parched no longer.

The sound of hammering and the pounding of engines struck up the hillside from the plain. He heard it even indoors, when he took his helmet off; and so, now, he would sit for hours with the helmet on. And still he seemed to hear the noise, striking resounding blows against his small plans, cracking them all down the middle.

Steel clashed against steel. Dust rose and settled, and rose again. The artificial stain, the imprint of man, spread

over the red beauty of the desert.

In the largest of the huts, shrouded in its anti-radiation covering, the final checks were made.

The commandant said: "You can promise action at scheduled time, professor?"

And the professor nodded. "Your men have done a good job. We're all set for full power in fifty minutes' time. And an hour after that——"

"Rain."

"The gentle dew from heaven," said the professor, who, though an eminent scientist, was also an emotional man and rather given to woolly outbursts of this kind.

The commandant studied him with quiet distaste. He hated to have his men taking orders from this scruffy little character. Yet the man knew his job, there was no doubt about that. His predictions worked out. It was men like him who made the laws today —their wishes and prophesies

were behind every governmental move, and their favours were courted by those in power. Little men like this, bald and untidy, their clothes stained, their eyes wide behind thick glasses, looked at a river and said: "Drain it." And it was drained, and a landscape was chopped up, and there was a uranium mine. They looked at an arid desert, made calculations, and said: "Let there be rain." And the workmen came, the towers went up, the generators and lines and reactors were shipped laboriously across space from the mother world; and there was rain.

"Well," said the commandant, "in another couple of weeks it'll all be out of our hands. All the men from the Ministry will be scuttling about and taking over."

He felt a momentary kinship with the professor. He did not like scientists, but he liked the little pipsqueaks from the Ministry of Interplanetary Development even less. Little black beetles, dash-

ing here and there, swarming over what the real toilers had achieved and smearing it all with regulations and official pronouncements . . .

The professor bobbed his head vaguely. He was not concerned. Provided the equipment functioned and justified his theories, he did not mind who took it over. Once he had been proved right, he had no further interest in the matter—he could go away and do something else, somewhere else.

Now he went meticulously from one dial to another. Power was building up satisfactorily. The reduction of the planetary sub-surface rock to its unstable elements was proceeding according to plan, and the production of the artificial cloud should be purely routine.

The commandant said: "Right. Time for deployment. The two for the five-mile check have left already. One at the foot of the range, you said. And one up near the farm. O.K?"

"Correct. It might also be interesting to get the reaction of the farmer up there to the whole project. Just for the record."

"For the record," said the commandant, "we've got it. He's not at all pleased."

"No?" said the professor indifferently. It did not matter. It was merely a statistic, and not a very important one—it would alter no equation and upset no plan.

The young lieutenant, in his sleek uniform, was sent up to the farm with a noteplate and orders to record observations at set intervals.

The old man greeted him with a surly nod.

"Pleased with yourself, huh?"

"Just doing my job," said the lieutenant. But it was true that he felt keyed-up, because it was a pretty remarkable thing, this generation of a cloud, and later the generation of an atmosphere for selected parts of the

planet—pretty remarkable, an achievement to be proud of, when you came to think of it.

He switched over the humidity control to clear his sticky helmet.

The old man, helmet grating into contact again, said, without sympathy: "Hot?"

"How you stick it I don't know." He looked down at the towers, and grinned. "I'll be glad to get rid of the sun for a while. You can get all the sun you want in the south of France, without coming all this way."

"I couldn't afford to go to the south of France." The old man laughed harshly. "I could only afford to come here."

He began to ramble on about the emigration schemes, the toughness that had been demanded of volunteers, the paid passages to loneliness and privation. He spoke of the loneliness of those early years with affection.

The lieutenant, moving away, had ceased to listen. He

got out his noteplate and impressed a preliminary observation on the smooth surface.

"Won't be long now," he said. And the old man did not hear him.

They waited.

In due time the cloud formed over the four towers. It clung to them for a moment, then detached itself, rose, and began to spread in a grey haze across the sky.

The lieutenant breathed a sigh of admiration.

The sun was dimmed. A cool shadow raced across the desert and ate its way up the hillside.

Like a stain, the mark of damp spreading over a floor.

The old man shivered.

They might have been standing there for minutes or hours when the rain at last began to fall. It drifted down like a fine curtain, then intensified and began to beat a tattoo on the ground.

The old man's face was expressionless. He indicated

the door of his house, and they went in. Windows shut against the sounds from below and against the dust were now blurred with rain.

They removed their helmets.

The lieutenant made a note. "Everything going just fine," he said.

It rained for an hour, and then the skies cleared. The lieutenant snapped his book shut, and stood in the doorway with a smile on his mouth. The old man came and stood beside him and said not a word. And then his arm came up shakily, and he was pointing.

"I bet you never expected to see that here, old timer," said the lieutenant affably.

"I'd forgotten." The words were barely audible.

Anger suffused the lined old face for a moment. The old man tried to turn away, as though to deny the existence of what he could now see. But it held him. He stared, and the lieutenantsaidnothing.

Something inside, some-

thing behind the old, set features, seemed to crack at last. Something broke down. The bleak eyes became as misted and uncertain as the landscape had been this past hour, and tears began abruptly to trickle down the twisted cheeks.

The lieutenant was taken aback. He looked up at the sky, and then at the old man. "Sure, it's pretty, but all the same . . ."

The old man saw the colours sparkling a thousand times, splintered again through his own tears.

"I'd forgotten," he repeated.

He had made himself forget—this among the other things, this perhaps in particular; for this had been a promise, and he had turned away from false promises and come to a planet which frankly offered nothing.

Now it was here, undeniable.

First the rain. And now the rainbow.

The rainbow . . . promise of better things to come. But in

his life there had never been those better things. He had been cheated, just as everyone else in this life would be cheated. Promises . . .

He turned to snap something derisive to the lieutenant, something that would cancel out the exquisite blandishments of the rainbow, and found him gazing slowly round at the landscape, appraising it with an odd, almost tender half-smile on his lips.

He looked young and eager. He saw what was not yet here, and believed in it fervently. Arrogant, maybe; but who wasn't, at that age?

The old man spoke. Even without his helmet, he could not make the words carry. It was as though he was reluctant, after all this time, to say such things.

The lieutenant glanced at him, coming back to realisation of him from a great, starry distance.

"What was that, old timer?"

"I was just asking—you got any family?"

"Sure have. Wife and two kids. You should see 'em."

"Yes," said the old man, wonderingly. "Yes."

"They'll be up here along with the rest in maybe six months time." He hesitated, then added, with boyish diffidence: "I'll . . . what say I bring them all up to see you?"

"Yes," said the old man. "Do that. I'd appreciate that. Bring 'em up to see me."

The rainbow had dissolved, though by staring at where it had been he could persuade himself that he still saw its faint glow across the sky, and the haze where it plunged into the red hills. He was very tired; suddenly he was tired.

At the same time he was scared, yet oddly at peace. Nothing within him was settled and sure any longer.

There would be youth and

hope and promise here; and he knew how such things could wither and turn bitter. But somehow he could protest no longer. He felt cleansed and new, and the world—this world—had been born anew.

The old man and the lieutenant shook hands, and the old man stood watching the younger man go down the slope. Then he went back indoors.

He sat down, and this time opened himself to the dreams which had been waiting to enter for so long. He relaxed, and thought of the things that were to come—of the rainbow he would see again, and of the promise of tomorrow and all the tomorrows, and of the new life that would soon begin to struggle here—to struggle, and then to flourish.

He accepted, and was content.

Crime, Punishment and Morals in the Future*

by Professor A. M. LOW

THE LAW IS, NATURALLY, always many years behind that elusive thing we call "public opinion," often centuries behind discovery, and the question arises whether, in the near future, we shall not have to consider much more frequent alterations in our laws. In the days when the amount of material change during a man's lifetime was small, it did not matter very much how long a law remained on the statute books. But today a single invention may completely alter circumstances in one generation and produce a set of conditions never imagined by those who made the rules of behaviour. Perhaps even more important, the social attitudes that really govern us far more than the law itself have changed. Murder is no longer common, not because of any change in the law, but because our moral values have become totally different.

Think of radio as an example of what can happen as the result of one single invention. The law concerning slander

was formed when the worst that a man could do with the spoken word was to shout it to a crowd of a few thousand. Today a man can speak to hundreds of millions and disseminate his slander much further and more certainly in a shorter time than by printing. When the laws concerning the various ways in which a man could be a traitor were conceived the idea that he might live in the enemy's country and daily speak to millions of his own countrymen would have seemed fantastic, yet this was the commonest form of treachery in the last war.

Many of the laws and rules of conduct laid down in the Old Testament, excellent in their day, have been made obsolete by scientific discovery and invention. Observance of those laws is, therefore, symbolical and often childish; we do not want spiritualists imprisoned under laws intended to deal with witchcraft, or recreation on Sunday governed by laws made to encourage the practice of archery several centuries

*From "It's Bound to Happen" by A. M. Low (Burke).

ago. The comedy and chaos of the betting acts arise from the fact that laws intended to protect wealthy gamblers from card sharps are now used to decide whether a workman may pay cash for his sixpenny bet on the Derby. The legality of operating football pools in some particular way is decided by laws conceived before pools were invented, and long before anyone could imagine a newspaper being able to print four million copies.

The present confusion in our outlook upon capital punishment and the finding of insanity in murder cases is a good illustration. The technical attitude towards insanity has undergone a revolution in the last century, but the rules which determine "legal" insanity still cling to the days when lunatics were thrust into an open dungeon or believed to be possessed of the devil. The public today believes that it is inhuman and wrong to execute insane men and women. It would not be hard, in the light of modern knowledge, to demonstrate that any person who commits murder is insane, but our laws and our ways of thinking are nearly 300 years behind the times. We calmly

ignore everything that has been learned about the mind during the present century and proceed to execute those who are "sane," that is, capable of knowing what they were doing, and, therefore, capable of reform. At the same time we so pamper those who are insane, that is, who suffer from disease and are virtually incurable, that a ripe old age is almost assured for anyone who is sent to Broadmoor Criminal Lunatic Asylum.

Where the question of sanity is raised, it is still a matter for the jury, a body of worthy men no doubt, but not skilled in examination of the mind, or, for that matter, in the weighing of the highly technical evidence which is given by experts. A man who would scoff at the idea of discovering the pressure in his car tyre by any means but a gauge will confidently give his opinion on the sanity or insanity of a man after listening to the arguments of lawyers, as if words could either establish or change facts.

In the future, we shall be far less ready to contemplate our over-full prisons with all the waste that is implied, or to think so complacently of a

large police force and a vast amount of undetected crime. People will decide to face the facts instead of giving vent to the feelings inherited from tribal days. The change is not likely to be dramatic, for, although we may accept the fact of material discovery readily enough, we find it difficult to adapt our mental attitude without long delay. The public, it seems, will not demand the abolition of capital punishment, but they might tacitly agree to the reprieve of every murderer. In some countries, although capital punishment is the law, there has been no execution for fifty years. This is an example likely to be imitated before long; only a few years ago hanging for theft was considered to be very proper.

Before long other means will be sought for "curing" criminals than by imprisoning them with their fellows, putting them on a low diet and providing harsh discipline or meaningless work. Looking back we may consider it fantastic that our parents persisted in such treatment in spite of its continued failure to bring results through so many centuries.

A society, tired of being

troubled by persistent offenders, will decide to examine the problem scientifically. They will decide that the remedy for stupidity—and although we call them "clever" only the stupid law-breakers are caught—is not to shut them up with other peculiar specimens, under-feeding them and giving work that provides neither interest nor reward, but to seek the cause of this stupidity. Perhaps it will be decided that all criminals must be abnormal, otherwise the majority of people would indulge in crime. It may be found that in many cases the cause of the failing intelligence is organic and can be corrected. A defective diet may be responsible, or various over-active or insufficiently active glands may be blamed. Unbalance of the endocrine system produces strange results. Even the idea of blaming a virus for criminal impulses would sound no more absurd today than it would have appeared ridiculous to credit scurvy to the lack of a minute substance in the diet of a century ago.

In many cases, no doubt, it will be found possible to correct abnormality. The E.E.G., the "brain-wave" re-

cording device, can already observe an abnormality in children which is often easy to correct but which, if left untreated, might well result in the child growing up as an habitual criminal. Systematic research may reveal that there are surprisingly few cases of crime that cannot be attributed to physical or mental abnormalities capable of surgical or medical treatment. Those in whom no apparent cause can be found will be regarded as of exceptional interest, and observation will probably pave the way to further discoveries.

Changes will obviously embrace the courts as well as prisons. It will be considered fantastic for judges to order punishments of which they have no real knowledge; only a very few of our magistrates and judges have ever regularly visited prisons or witnessed flogging or hanging. This will be considered as unscientific as a doctor ordering a medicine of which he has no knowledge at all, but which he has heard to be the "right thing." Courts will be concerned not only in ordering punishments, but in considering treatment. They may advise so many months of sedatives, as modern courts order so

many months imprisonment. They will certainly attempt to make the treatment fit the cause of the crime and not the crime itself; they will not delude themselves that the man who has committed bigamy, the man who has killed another as the result of carelessness and the man who has burgled a bank will all benefit by the same retribution.

A court will not always require men to wear fancy dress or false hair to give them importance. Counsel will not try only to prove that a man is guilty or innocent, but will attempt to discover whether or not he requires treatment. Examination will be as unemotional as that of a surgeon who examines a patient suspected of some operable abnormality, and the relationship of judge and prisoner will eventually become more that of doctor and patient.

Such a change of attitude suggests the possibility that judges may one day be willing to discuss abnormal tendencies with criminals prior to the commission of crime. Perhaps there will be clinics where those who have broken the law, or feel the impulse to do so, can secure expert

advice. If it is found necessary for them to become "inpatients," little more will be thought of it than as an entry to a nursing home. Fanciful perhaps, but no greater advance in comparison than are our methods today from the time of trial by ordeal.

A discovery that may have far-reaching effects, possibly harmful unless it is well considered, is the modern technique of artificial insemination. That this subject should have been discussed by the House of Lords is in itself a sign of progress; fifty years ago the topic would have been thrown out as unfit for public discussion and a law would have been passed forbidding everything to do with so startling an "innovation" which, by the way, was known in Ancient Greece.

The insemination debate in the House of Lords brought no conclusion, although a simple recognition that new discoveries must profoundly affect our lives, in the ethical as well as the material sense, was in itself noteworthy. The traditional method of all legislative bodies has been to ignore new and awkward facts until these have made themselves so painfully felt that

hasty and often ill-devised corrective methods must be taken. Too little and too late.

The barbaric stigma of illegitimacy, rising divorce figures, a birthrate with no relation to economics, increasing mental deficiency and decreasing average intelligence; these and other problems will never be truly faced, much less solved, until new facts are openly recognised. Instead, there will be legal tinkering, the introduction of easier and easier divorce or abolition of the legal, but not social, handicaps of illegitimacy.

There is yet another problem that the future must face. Some progress has been made in sex determination. Before very long it may occasionally be possible for parents to choose for themselves whether they will have a boy or a girl. The natural processes by which the ratio between male and female population is maintained could then, to some extent, be in the hands of men to control. Will future generations face this challenge and decide how it should affect their laws and social behaviour, or will they bury their heads and declare

that it is "unnatural" until the time comes when chaos threatens? It might be too late to achieve what seems immediately desirable by selective taxation, the offer of bribes or even the state ordering of sex. We have only to consider that, at present, when parents can choose the sex of their adopted children, the demand is ten times as great for girls as boys, to see the grave economic implications that will arise if sex selection becomes generally practicable.

To ignore facts is not a remedy. Inventions cannot be legislated out of existence, and it is only by full presentation of the facts to the public that a proper solution of the problems caused by progress can be decided. Future men and women will not be hypnotised by words and slogans as we are today. To condemn these new practices as against

nature is to take refuge in an outmoded phase. It is the word-magic of the tribal medicine man dressed in twentieth-century clothing. An aluminium leg is "unnatural"; so is an operation for appendicitis or the use of disinfectants. It is history that anaesthetics was condemned as irreligious, and although this is not a common view today many mothers-to-be suffer from the old prejudice. The generations to come will soon regard physiological processes as an extension of the control over environment which has helped man to retain his position as the most successful of all animals. Materially and legally, control of our species may be regarded as a very natural development of the process of selection for which the "artificiality" of Rhesus tests before marriage are a useful form of insurance.

PRIVATE SATELLITE

is the title of next month's lead story, by popular AUTHENTIC author Jonathan Burke. Short story contributors include E. C. Tubb, H. K. Bulmer and competition winner Alan Burns. Usual illustrated non-fiction features by scientific experts.

AUTHENTIC ————— A MONTHLY MUST

Two lives were at stake and he had to make a—

DECISION

by E. C. TUBB

JOHN GIBSON HAD always thought that the waiting room of the General Mercy Hospital must be similar to the annex to hell. It was a large room, the floor of stamped dirt puddled with wet, the walls of cracked and broken concrete seeping with moisture and mottled with slimy lichen and creeping moss, the roof a mass of splintered beams pierced by a single, dirt-encrusted skylight. A few rough benches rested against the walls and, sitting on the benches, squatting on the floor, pressed against the walls or humped into corners, waited the most concentrated distillation of human misery the world had ever known.

John sighed as he saw them, feeling the grit of fatigue rasp his eyeballs and the burning discomfort of too many sleepless nights churn his stomach.

It wasn't the assembled misery which upset him—he had seen too much misery in his half-century of life—it was the growing knowledge that there wasn't anything he could do to alleviate it, that there wasn't anything anyone could do. He looked at the woman at his side.

She was thin, too thin, but that was normal now. Her eyes glistened with drug-induced wakefulness and her hands quivered in constant motion as she toyed with a set of cards so marked, erased and marked again as to be almost indecipherable. She wore a smock of a drab grey colour. Once it had been white, and had long ago abandoned any effort to appear attractive.

"Have you sorted them, nurse?"

"Yes, doctor." She didn't

look at him, but there was no mistaking the despair in her voice. "It's getting worse. Two hundred and eight this morning. About seventy stand a chance of being helped, the rest . . ."

"We must do what we can." John reached for the cards. "I'll take maternity. Collins, flesh wounds and minor injuries. Fenshaw, chronic illness, radiation sickness, incurable and internal diseases. Send them in strict waiting-rotation; some of these poor devils have been waiting two days now."

"Yes, doctor." She hesitated. "After maternities?"

"The hard ones; use your discretion." He gripped her shoulders and turned her to look at him, smiling into her eyes. "One other thing, Sally, and this is important. We don't want you cracking up on us, so go easy on the benzedrine, will you?"

"Yes, doctor." She tried to smile with her bloodless lips and the glitter in her eyes increased as she stared at him. "And you?"

"I'll manage." He patted her shoulder. "You've got to get some rest, Sally. We need you too much for you to take chances."

"Yes, doctor." The title came with the ease of ingrained habit but the hunger in her eyes left no doubt as to the word she would rather have used. "It's nice of you to say that, but I can always be replaced—you can't."

"Where could I find another trained nurse?" John shook his head. "There may be some more doctors around but you're more than just a doctor. You are a diagnostician now, and you save us an endless amount of time. No, Sally, I'd rather lose Collins or Fenshaw than you."

"You have other nurses."

"I know that." He smiled at her again, shaking her gently as he gripped her shoulders. "I'm not going to flatter you, Sally, so you can stop fishing for compliments. You know how much you mean to me."

She flushed, a rising tide

of red suffusing her sallow features and restoring for a moment something of her lost beauty. For a moment she clung to him; then, as habit and ingrained duty overcame desire, reached for the cards and began to call out names.

The procession to hell began.

It had begun three years before, when the soughing whine of falling missiles had painted the night with flame and mushroom clouds of smoke. It had begun when London vanished in a cloud of radioactive glory, when Liverpool and Newcastle, Glasgow and Manchester, Bristol and Portsmouth and a dozen other big cities had glowed and slumped and ran into heaps of molten slag. It had begun within the space of twelve hours in which half the population had died with merciful swiftness and it had carried over for another seven days, during which three quarters of the remain-

der had spewed out their lives in uncontrollable vomiting.

But it hadn't ended there.

A man can lose a leg and he will live. A man can have his limbs severed, his eyes taken out, his ears destroyed, his senses dulled and rendered useless, and still he can remain a reasoning, intelligent entity. But no nation can have the heart and guts ripped from it and hope to recover, to carry on as usual, to remain a close-knit unity. England was dead—but it was a long time dying.

John wished that he had died with it.

He sat at his desk and stared at the file of maternity cases Sally had sent in from the waiting room. They were all the same, dull-eyed, indifferent, without imagination or the subtle something which would inevitably have driven them from their tiny villages into the big cities. They accepted life as it came and already most of them were ridden with superstition. Tiredly he went through the

routine, knowing that he could have been an African witch doctor, masked and mumbling incantations, for all the impression he was making.

Blood counts. Geiger tests. Tracer elements. Albumen reaction. Teeth and skin. Wasserman and smear. Test for diabetes, for cancer, for radiation sickness. Test for vitamin deficiency, for calcium lack, for malnutrition. He didn't have to test for intelligence.

"How are you feeling?"

"Sick, doctor."

"You'll get over that. Now this is what you must do. Drink plenty of milk, boil all water, wash frequently, eat plenty of vegetables, stay away from all radioactive areas, refrain from lifting heavy weights, don't wear tight clothing. Don't drink too much. Get plenty of rest. You understand?"

"Yes, doctor."

They didn't, of course; how could they? Drink plenty of milk—when a cow was

something most of them had only heard of. Wash frequently—when there was no soap. Stay away from radioactive areas—when they didn't know the meaning of the word. Plenty of vegetables—nettles, lettuce, berries, some wizened fruit. All hard to gather. All hard to cook—and there were plenty of rusty cans still to be found—if you went into the radioactive areas. Don't drink too much—when it was their only pleasure. Rest—how?

He watched them file out, knowing that half of their expected children would carry the inheritance of their parents' gift of blindness, distorted bones, congenital disease as proved by the Wasserman and smear tests. And yet there was nothing he could do to prevent it. No doctor can cure a patient if the patient won't take the trouble to be cured. Even if he has the intent he still needs the essential drugs and medicines, and the drugs had vanished along with the thous-

and other needs of civilisation when the alphabet bombs had drifted down from the sullen clouds.

Tiredness clawed at him and he almost yielded to it, resting his head on his folded arms and closing his eyes, letting his body relax and slump against the edge of the desk. Memories came swimming to the forefront of his consciousness—white-tiled corridors and polished floors, rows of neat white beds and attentive, neat, white nurses. The gleam of sterile steel and the glare of brilliant lights. Ranked ampoules of drugs, the slender perfection of hypodermics, the miracle of modern surgery.

"John."

He started, blinking and feeling the sudden pounding of his heart as he surged upwards from the desk. Collins stood before him, a steaming jug in one hand and some thick, cracked china cups in the other.

"Tea?"

"Thanks." John rubbed his

eyes and wondered if he should take another benzedrine tablet. He decided against it. The supply was getting low and he had driven himself too far as it was. He sipped at the hot brew, grimacing at the herbal tang, and felt brief regret at lost pleasures. "How is it going?"

"As usual." Collins shrugged. He was a young man, twenty years younger than John, and still had the cynical indifference of youth to the unfortunate. "I've looked at a few scratches and sewn up a few cuts; all I can do, really." He sipped at his tea. "How's the new generation?"

"They'll arrive." John tried not to show his irritation at the other's levity. "If you've cleared your cases how about starting on the chronics?"

"Why?" Collins stared directly at the elder man. "What good will it do?"

"It will relieve me and Fenshaw for one thing. I won't mention common humanity. If you haven't

heard of it yet it's a bit late in the day to start."

"I'm a realist, John. What possible good can we do to a man dying of radiation sickness? The only real mercy we can give him is the easy way out. The same applies to most of the other chronics out there. They are just wasting our time."

"I see." John stared down into his cup, not seeing the dark brown, almost transparent liquid it contained. "Carl?"

"Why do you insist on ascribing everything I say to the influence of Carl?" Collins set down his cup with exaggerated care. "I can think for myself, John. That I happen to believe that Carl is right in a lot of what he says is merely coincidence."

"Is it?"

"Yes."

"You are a doctor, Collins," said John quietly. "As such you took a certain oath. Must I remind you of it? Must I bring to your notice that bit about 'comfort to

the dying'? A doctor isn't just a mechanic, Collins; he has a greater duty towards humanity than to repair their bodies—if they are repairable. Those people out there look towards us for help. Some of them have waited two or more days just to get to see us, some of them have travelled a long way. Are you asking me to turn them away? Is that the kind of man you think I am?"

"I didn't say that."

"You inferred it. You think that I'm soft, weak; in fact you think that I'm a fool. You have thought so ever since I refused to fall in with your plan to make all patients bring us food and material before they could expect treatment. Mercy isn't for sale, Collins. I told you that then, and I tell it to you now. Mercy is something you give away—or it isn't mercy."

"Mercy has nothing to do with it."

"Mercy has everything to do with it. That is why we elected to become doctors—

not for the fat fees we could expect from the job, but because we wanted to do something to help our fellow men. If you thought differently about it in the old days, then you shouldn't be what you are. A doctor is a man of mercy, Collins, not a highwayman with a gun."

"I don't have to listen to this." Collins stepped back from the desk, his thin features flushing with anger. "You're living in the past, John, and you won't admit it. How can we cure those wrecks out there? We've no penicillin, no sulfa drugs, no irradiation lamps, no special equipment. More important of all we've no beds or staff, no nurses, nothing to take away what they are or to help them in any way. All we can do is to kill them—or let them linger in agony for the remainder of their lives. Is that being stupid? I say that it makes good sense."

"And so does Carl?"

"Leave Carl out of this."

"Carl won't stay out." For

the first time since the young man had entered the room John felt the surging warmth of anger. "Carl is a would-be despot, a dictator, an idealist if you like, but dangerous all the same. This is my hospital, Collins. Remember that. I made it what it is, settled here, cleared out the rooms and searched around for the few drugs and instruments we have. You weren't here then. You don't know what we had to do, Sally and I, to get this place going. It's mine, and while I'm here you'll do as I say. No one, remember that, no one will come here for help to be turned away. This is the General Mercy Hospital, not the local bargain counter, and if you don't like it you know what you can do."

"Maybe I will."

"You're not threatening me, Collins. A bad doctor is worse than no doctor at all. Go if you like, but while you remain here you'll obey my orders."

For a moment they stared

at each other, the older man, his face sagging with fatigue, his body slumped with weariness, and yet with his eyes bright with the inner fires of his conviction. Collins stared back, hard, brash, certain that he was right, almost contemptuous of the other man's idealism, and yet, as they stared at each other, it was the younger man who admitted defeat.

"Sorry, John. I suppose that I'm just too tired to think straight."

"Forget it." With victory came lassitude and a craving for peace and quiet away from the clash of wills and the storms of emotion. "We're all overworked, but things may get better soon. When the midwives are trained and the visiting nurses established we should be able to take things a little easier. Anyway, I want to get started on the medical school as soon as possible; the quicker we train some new blood the happier I will be."

"What about them?" Col-

lins jerked his thumb towards the waiting room. "You think that they will get less?"

"We must tell them the truth. We're only wasting their time and arousing false hopes by offering something to them we can't accomplish." John flushed as he saw the expression in the other's eyes. "I, too, can be a realist, Collins, but there is a big difference between handing a man a gun and telling him to shoot himself, and helping him to accept the inevitable with kindness and understanding. We can tell them the truth, but we needn't be sadistic about it."

"We should have a priest," said Collins cynically. "They used to be pretty good at that sort of thing."

"Yes," agreed John shortly. He reached for the bell wire. "Let's get back to work."

The first man was a victim of his own ignorance. He was dying and didn't know why, but John could tell that he had blandly dis-

regarded the overall command never to enter a contaminated area. He shook his head as he finished the tests.

"Can you cure me, doctor?" The man leaned forward with pathetic faith in the power of the man in charge. "I feel sick and can't work as hard as I did."

"I'm sorry." John hesitated at the naked panic in the man's eyes. "You'll have to take things very quietly from now on. Rest as much as you can, sleep all you want to, eat plenty of good food and get out in the sun." He reached for the bell wire.

"Aren't you going to give me something?"

"Nothing I can give you will do any good. Rest and food are all that can help you. I'm sorry."

"But . . ."

"I'm sorry."

It hurt to see him go. It hurt not to be able to give the lying words of comfort, the useless injections, the bottle of coloured water. Nothing could prevent the

man's death, but now, devoid of the trappings of faith, he would die cursing the "doctors" who had refused to help him. Slowly John pulled the bell and signalled for the next patient.

A mother entered with a bundle in her arms. It wasn't a baby she carried, but a ten-year-old boy, lank haired, loose mouthed, dangling limbed. Not an idiot; that would have been kinder; an idiot would have been taken care of in the old days and would have died as the rest had died. Her son was a spastic, one of those unfortunates who, while mentally sound, had such poor control of their bodies as to be a constant burden on those around them.

There was nothing John could do.

The drugs hadn't been invented to cure the condition. The schools to train spastics had vanished with their staffs and all he could do was to sympathise with the mother and express his regret. She

left, carrying her cross, her eyes bitter with frustrated hope.

An old man was next, twisted and crippled with arthritis, ill-tempered through pain and hunger, truculent as he compared present conditions with his memories of snug, warm hospitals with their attentive nurses, sympathetic doctors, and the endless treatments which had made his illness a thing to while away the lengthening hours.

Then came a man with jaundice, a woman with varicose veins like swollen purple plums on her legs, a child with mastoid, another with rickets, a third with pus-filled oozing eyes. A boy with a humped back and swollen throat, a man with diabetes, a woman with cancer of the breast, another with a dropped womb, a third with fatty heart. Two men with radiation sores and one with gangrene of the arm. A girl with milky white cataracts in her eyes and another with

puerperal fever. A family suffering from tuberculosis, then a man with acute appendicitis . . .

John could do something about the jaundice, nothing about the varicose veins because the woman refused to allow an operation. He booked the mastoid for the theatre, told the mother of the boy with rickets to give him plenty of milk and green vegetables, shook his head over the ruined eyes. Nothing for the glandular trouble; the diabetes—there was no insulin; the cancer—toe far gone for operation; the fatty heart. Nothing for the radiation sores, but amputation for the gangrene. Operation for the cataracts; no drugs for the fever; nothing for the tuberculosis. The man with appendicitis . . .

The hospital wasn't geared for emergency operations.

John felt sick as he stared down at the limp figure on the improvised operating table. The operation was such a simple thing—with the

correct equipment and staff. The anaesthetic, the incision, the sutures and clamps, the scalpels, the forceps, the swabs, the brilliant lights and attentive nurses. Then the removal of the inflamed organ, the cleansing, the tying, sewing and final dressing. A few hours' work, less than that, followed by ten days hospitalisation. As simple as having a tooth removed, as blowing a nose, as trimming an inconvenient toenail.

But the man was dead.

Lack had killed him. Lack of staff, of drugs, of equipment and time. Mostly lack of time, caused solely by the crowded waiting room, the sheer necessity of taking each in their turn, the time wasted on seeing patients who hadn't a hope in hell of direct benefit—and because of that a man had died.

A young man, a farmer, one who had grown up on the land and who, by his skill and experience, could have grown the food essential to the community. Dead so that

others could receive the psychological benefit of telling their troubles to a doctor.

John slowly peeled off the rubber gloves, patched now and worn, slipped off the mask, futile pandering to almosten forgotten Gods of hygiene and, hanging his gown on a peg, turned towards the door.

He didn't want to meet the accusation in Collins's eyes.

CARL HAMMOND STOOD on the brow of a low hill and stared through field glasses at a thin line of cyclists moving slowly along an overgrown road. He was tall, with close-cropped dark hair, broad shouldered and thick-limbed. Arrogance rested on his heavy features and his mouth, thin and cruel, betrayed his driving ambition. There was nothing soft about Carl, nothing gentle. He was a realist and, during the past three years, had lived more than all his previous thirty. He lowered the glasses as

the last of the cyclists vanished around a bend in the road.

"Right, Janson. Send off the other column."

His sergeant, a short, stocky, scar-faced man, saluted, yelled harsh orders to a waiting knot of men, then turned back to Carl.

"You expect trouble, sir?"

"No. If our intelligence is correct they'll be glad to see us, but I don't believe in taking any chances." Carl stared briefly through his binoculars. "This is about as far north as we can go, isn't it?"

"Yes, sir. The radiation is dangerous further on."

The sergeant hesitated.
"Sir?"

"What is it?"

"May I tell the men that we're returning to Base after this operation? They're getting a little restless. We've been out a month now and they don't like getting too close to the contaminated areas."

"I don't blame them." Carl slipped the field glasses

into a leather case, closed it, and slung it behind him, then stood, his hand resting on the butt of the machine pistol at his side. "They've worked well and deserve a rest. You can tell them that we'll be heading back as soon as we've swept this area."

"Yes, sir. Thank you, sir."

Carl smiled at the gratitude in the sergeant's voice then frowned as he winced. "What's the matter?"

"It's that wound on my leg, sir. It doesn't seem to be healing, and having to cycle everywhere we go isn't helping it."

"Haven't you been for treatment?"

"I went once, sir, but the waiting room was full and I couldn't wait."

"I'll get you treatment when we get back," promised Carl. "I can't have my right-hand man incapacitated for the lack of a little attention. I . . ." He broke off as the harsh blast of a whistle echoed towards them. "They made contact!"

Both men waited, each tense; then, as the sound was repeated in three short blasts, they relaxed.

"Friendly. I thought that they would be." Carl turned to where two cycles leaned against each other. "Come on, Janson, let's see what we've found."

It was the biggest find to date: over sixty people, twenty of them women, together with stores of canned food and heaps of salvaged equipment. Their leader was a priest, an old man still managing to appear dignified in his soiled robes of rusty black, and his face beamed with excited gratitude as he ran up to Carl.

"Heaven be praised for this day, my son. I had begun to think that we were alone."

Carl nodded, not answering the old man, his eyes busy as he mentally evaluated the assembled group. The women—good, there was always a need of women if for no other reason than to mother

a new generation. The men? Some useful acquisitions, young and healthy, or they would be, once they were fattened up a little; good workers for the farms and the reclamation squads. The oldsters—not so good, but some of them might prove of service if only to chop wood and carry burdens.

He frowned at the sight of a boy on crutches.

"Who's that?"

"Jimmy?" The priest looked compassionately at the cripple. "One of the unfortunate victims of man's inhumanity to man. He was caught in a fire, his legs were badly burned. I fear that he will never walk unaided again."

"I see." Carl nodded, his eyes heavy with inner thoughts. "How is your general health?"

"As well as can be expected. Some radiation burns—a few of the younger men took grave risks in gathering the few things we have—and most of us could do with more to eat, but, thanks be

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to merciful God, we have not suffered from plague."

"Good." Carl glanced towards the sinking sun. "With your permission, sir, we will stay here tonight. You can feed us?"

"It will be a pleasure."

"Then it is settled. Janson!"

"Yes, sir?"

"Billet the men. Set guards."

"Yes, sir." The sergeant saluted and Carl turned to meet the priest's puzzled stare.

"There is no need for guards, my son. Aside from us this area is devoid of life."

"Are you certain of that?"

"Only too certain. The hand of God fell heavily on the sinner and few were spared to sing His praises. I..."

"Yes, but how can you be certain?"

"We searched, my son, and at night lit great fires to attract any that might be in need of help and aid. Some answered the signal." The priest bowed his head as if in silent prayer. "They were very few."

"No marauders? No looters? No roving bands?"

"None, my son. God has been very good to us."

"I see. I can take it then that your band is the sum total of life in this area?"

"That is so."

Carl sighed. He had half-expected the answer, but it still wasn't nice to hear. If the priest was right—and there was no reason to doubt his word—then the entire active population in this area of England was less than five thousand men, women, and children.

There were others, of course, there had to be, but the sprawling bands of the contaminated areas barred all contact other than by aircraft—and there were no operating aircraft. Bristol to the north, Plymouth to the south, Portsmouth to the east and, further east still, the bubbling pit of transmuted hell that had been London. Taunton had caught it, too, and Salisbury, bad enough to demolish the towns

even if they no longer spread wind-borne radiation, but the damage had been done by the first fury of the streaming radioactive particles.

Carl's domain occupied a pitifully small part of England.

Over a meal of greasy stew, redolent of wood-smoke and heavy with the taint of canned meat, Carl discussed future plans with the priest. He had learned the man's name by now and, as they talked, his respect for the other's intelligence mounted in direct ratio to his contempt for what he represented.

Carl had never had any time for religion. He couldn't understand the supreme self-submergence required by the orthodox faiths and, because he was above all things an individualist, he instinctively revolted against ascribing to the will of a deity the acts of men.

Father Wendle wasn't like that. He was a man with a supreme conviction in his God and daily gave prayerful

thanks that he had been spared from what he firmly believed to be the punishment of God upon the sinful acts of men. Both men were intelligent, but neither could ever agree on a single point of view.

Carl tasted the stew, rolled a piece of meat around his tongue, and looked sharply at the priest.

"This meat is bad."

"Yes, but I made certain that it was wholly bad before using it. There is no danger of ptomaine." Wendle smiled. "If there were we should all have been dead long ago."

"Where did you learn that?" Carl stared with increased respect at the old man. "Most people would have chosen to eat meat that was on the turn rather than wait for the lethal bacteria to die and be rendered harmless. Not many people know that while it is safe to eat rotten flesh, it is suicide to eat meat that is only half bad."

"I had some training in

my youth. It was an early ambition of mine to become a missionary, but God decided that I would serve Him better at home."

"You've had medical training?"

"A little."

"A doctor, perhaps? We need doctors badly."

"No. I can bandage a wound and administer an injection. I know a little of first aid, the pressure points and so on, but nothing more." Wendle smiled apologetically. "I could help, but I have no knowledge of my own."

"I see." Carl hid his disappointment. "Did you find any drugs during your searches? Any medical equipment of any kind?"

"A little. Some first aid kits, iodine, bandages and so on. I'm afraid, though, that most of the hospitals were destroyed and their equipment with them."

And that, of course, was the answer. Hospitals were almost always near the big cities—they had to be, in

order to be efficient, and even the few cottage hospitals rarely contained anything more than emergency stores. The incredible intermeshing of transport, the ambulance services, the inevitable trend towards specialisation, all had contributed to the vulnerability of the medical services. The cities had gone up in radiant ash—and the hospitals with their essential stocks of drugs, their trained staffs, their libraries, their distilled knowledge and techniques, all had gone up with them.

And there could be no replacements.

Not when it took a titanic factory to produce penicillin. Not when it took skill and precision tools to manufacture hypodermic needles, forceps, scalpels, clamps, needles, trepans and the thousand and one essential instruments in daily use in modern operating theatres. The instruments could have been spared; almost anything can be turned into a scalpel if the rules of

hygiene are observed, but there was no possible way of replacing the drugs and anaesthetics. Those were the products of industrial chemists who provided the doctors with a constant stream of what they needed. Medical training did not include procedure on how to manufacture ether from rubbish, chloroform from soil, sulpha drugs from rusty iron. And that was all they had to work with—dirt and rubbish and rust.

It couldn't be done.

Carl sighed as he emptied his bowl and frowned at the assembled band he had discovered. He was pleased to see that his own men kept a little apart from the others. Already they had a sense of pride in that they were different from the spiritless men and women of the new community. Wendle noticed it, too.

"Your men, if I may call them that, seem to be afflicted with pride."

"Afflicted?" Carl raised his

eyebrows, then laughed. "Of course, I had forgotten; one of the seven deadly sins, wasn't it?"

"It is, my son, not was. Pride goeth before a fall, remember? The world was proud, and where is the world now? Dust and ashes beneath the heel of the Lord."

"My men have something to work for," snapped Carl shortly. "They have a nation to rebuild, and no time to waste in doing it."

"A laudable work." Wendle stared around at the assembled men and women, noticed that they had all finished their meal, and lifted his arms towards the darkening sky. "Let us give thanks!" he cried in a strong voice. "Let us give humble thanks to our Lord for his infinite mercy in giving us this day our daily bread . . ."

Carl sat motionless during the long and semi-hysterical prayer. His men, he noticed, also sat, a little uncomfortable but following his lead. He was glad to see it. Wendle,

he guessed, must be a little insane. Probably the hell he had passed through had warped his judgment so that he had lost his normal footing and turned into the thing orthodox religions had always regarded with detestation. Wendle had become a religious fanatic.

Fanatic or not, his hold over his "flock," as he called them, was immense. Carl stared at their rapt expressions and recognised the danger for what it was. He forced himself to smile as Wendle sat down again.

"You pray often?"

"Often." Wendle drew a shuddering breath. "Only by constant prayer can we hope to keep the evil one at bay."

"Tell me." Carl hunched a little nearer to the old man. "What provision have you made for farming? These huts," he gestured towards the crude board and wattle cones forming the "village," "they won't last for ever. Have you a programme of construction?"

"The Lord will provide."

"He has already done that," said Carl drily. "You surely don't expect Him to bake bricks and plant the crops as well, do you?"

"We are but straws in the wind," said the priest wildly, and from the glitter in his eyes Carl could tell that he was still in the grip of fanatical hysteria. "If we are worthy, He will provide. Did you not come to our aid? Who are we to question the immutable workings of the Lord?"

"Please." Carl tried to disguise his impatience. "I can respect your faith even if I cannot understand it, but you are talking like a fool. Religion has nothing to do with the necessity of rebuilding our nation. Sweat will do it, hard work and constant effort, but I have yet to see a house constructed by prayer alone, or crops planted as the result of words. What are you doing to restore the things we have lost?"

"We have done what we

could." Wendle calmed himself as he looked at the younger man. "We have scoured the vicinity for stores and I have founded a school to teach the children. We have lived; more than that I cannot claim."

"Even to do that was an achievement," admitted Carl. "This area is rotten with radiation and it's a wonder that you managed to survive at all. You'll find things different at Base."

"Base?"

"The new Capital. We have a school, a hospital, a community centre. I've started a smithy and we can work iron. Our soil is free from poison and we are planting crops. We even have a few animals." Carl smiled as he thought of his plans. "I tell you, Wendle, we're on the road back! A generation, two at the most, and we'll have the founding of a new nation!"

"Zion!" Wendle glowed with reflected enthusiasm. "It was a miracle that you found us. You have a church?"

"No," said Carl deliberately. "We have no church and no priest—and we don't want either. We can do without superstition."

"Sin!" Wendle recoiled as though he had touched a glowing coal. "Infamous sin!"

"Sin?" Carl shrugged. "What is 'sin'? Only something which you people have decided to call by that name. I refuse to recognise your 'sin'. To me there is only one crime, and that is for anyone to refuse to do their utmost to help rebuild England. I am merciless with such people. But must I forbid the new generation because we have no priest to mumble a blessing? Must we regard our children as being damned merely because they are born? Don't be a fool, Wendle. We have no time now for the playing of games or the giving of lip-service to unworkable ideals."

"Absolution," said the priest wildly. "I can give full absolution."

"You will give nothing—

except all you own." Grim amusement tugged at the corners of Carl's too-thin mouth. "You have lost your power, Wendle. I cannot have a divided loyalty. Every thought, every action, every moment of time must go towards rebuilding the nation. We have no time for prayer, for rest, for the contemplation of the infinite. These people you call your flock will be absorbed into Base. All those that will be of some use, that is. You can help if you so decide, but you must swear that never, at any time, will you attempt to sway the hearts of men with your religion. Do you swear?"

"I cannot! What you suggest is wrong! Wrong! Wrong! Man cannot live by bread alone. Those who grovel in the dirt will become stained with the mire. Man needs God as he has never needed anything else. Without God we are as animals, with Him we are as Angels."

"Your faith has had two

thousand years to work its magic." Carl pointed towards the blue-lit horizon. "Is that the work of God? If it is, then we can do without your faith. The planet cannot stand a second such demonstration of Brotherly Love."

"You know better than that." Wendle stared at Carl and now his eyes had lost all trace of their previous hysteria. "Did the Church invent the bomb? Did the priests and worshippers blast the cities into dust? It was not the Church which did this thing. Blame the men who had pride without faith. The men who, like yourself, put their trust in material things and who, swollen with arrogance, would not humble themselves or turn the other cheek. It is better that such men are dead."

"You evade the point," snapped Carl. "Will you do as I say?"

"I cannot. Men must have something to lift them above the beast." Impulsively the priest gripped Carl's arm.

"Listen to me! Think of a new England, a land peopled with happy men and women, and smiling children. No cruelty, no arrogance, no pride, no lust for the trappings of power. A family of men and women, brothers and sisters in God. Forget your love of the material and, instead, seek for the far stronger things of the spirit. Do that, my son, and..."

"No," interrupted Carl impatiently. "We must be strong, not weak. To do as you say would be to invite chaos and anarchy. That is not the way to survive."

"Blessed are the meek," reminded the priest, *"for they shall inherit the Earth."*

"Stop it!" Carl gripped the shoulder of the priest. "We will do things my way. My way, understand? You will remain behind, the cripple, too, and all the rest of these fools who are too weak to march and work. Janson!"

"Sir?" The sergeant stepped forward, his eyes eager with the anticipation of action.

"We've wasted enough time. Sort out the useful from the useless. Load the chosen with stores, all you can find—you know what to take. Eliminate anyone who attempts to hinder you. Move!" Carl stared into the horrified eyes of the priest.

"Sometimes it is necessary to be cruel in order to be kind. I mean no harm to your people, but they must learn to forget your nonsense and obey me instead of you and your God. Isolated as they are, they can neither help themselves nor others, and I will not leave them to store up trouble for the future. We want no internecine wars to slow progress later on. One nation! One leader! One purpose! That is the only way to restore our former greatness."

"You think that you are hard," said Wendle quietly. "But you are not hard. It is easy to refuse responsibility, to shout and bluster and be a slave to what you are pleased to call your 'duty.'

But that is the coward's way. It takes a brave man to accept his burdens and admit what he is." He looked at Carl. "You will not take the boy because you know that he is a part of you, as each man is a part of each other, united in God. The cripple is better than you, for he carries his cross where all can see it. You, too, have a cross—but it is not the one you think it is."

"Philosophy," sneered Carl. "Is that all you can do?"

"I could curse you, but I will not. Instead I shall pity you, for of all the men I have met, you are most in need of pity."

"Fool!" Carl thrust the old man from him as he rose. "Pity? Curse me if you will but save your pity for those who need it. I need nothing you can give me."

"Are you certain of that?" Wendle looked up from where Carl had thrown him. "This is your hour, my son.

Tomorrow it may be another's. Can you demand charity when you refuse to give it? Are you ready to meet your God?"

Carl laughed as he walked away.

THE WAITING ROOM was, as usual, full when Carl entered the hospital. Janson limped after him, his scarred face twisted with the pain from his injured leg, and swore when a man bumped into him.

"You!" Carl pointed towards a man sitting on a bench. "Get up!"

"Why?" The man didn't move. "I was here first."

"Get up!" Carl strode forward, gripped the man by his shoulder and, half-lifting him from the bench, threw him towards the centre of the room. "Sit down, sergeant. I'll get some action around here."

Sally met him at the door. She was white, strained and, as usual, over tired and over worked. "What do you want?"

"Where's Gibson?"

"Doctor Gibson is attending surgery. Shall I make an appointment?"

"You can make what you damn well like—just as long as I get some attention from you people. Where's Collins?"

"Attending surgery."

"Fenshaw?"

"The same."

"Are you trying to be clever with me?" Carl scowled down into her white face. "Listen. My sergeant's in trouble and I want him treated."

"If he registers at the desk the doctor will see him as soon as possible."

"I want him treated now."

Irritably he pushed past her. "Collins! Gibson! Where the hell is everyone?"

"What's the trouble?" John stepped out of his office just as Collins joined Sally and Carl in the corridor. "Do I have to remind you, Carl, that this is a hospital? Save your shouting for the parade ground."

"What's the trouble, Carl?"

Collins stepped forward.

"Anything I can do?"

"Janson's got a wounded leg. We've been on the road for over a month now and it's been giving him hell. I want you to treat him."

"Certainly. Where is he?"

"Outside."

"Bring him in." Collins looked at Sally. "Well? Didn't you hear me? Bring the patient in."

"Just a minute, Sally." John stepped forward and caught her arm. "Janson will have to wait. There are others out there who've been waiting a long time now. They must come first."

"Must they?" Carl took a deep breath. "Listen. We've a lot of work to do and Janson can hardly stand. You'd treat an emergency, wouldn't you? Very well then, consider him as an emergency."

"Is he dying?"

"No."

"Is he in immediate danger of death from loss of blood?"

"You know damn well he isn't."

"Then where's the emergency?" John shook his head. "Sorry, Carl, but your man will have to wait his turn."

"You . . ." Carl gritted his teeth against his rising anger. "Janson is important to me and I want him to receive treatment. I can't spare him for a few days until you decide to make up your minds as to whether you'll condescend to see him or not. Now, do you attend him or . . ."

"I'll attend to him," said Collins hastily. "Bring him to my office."

"Good. I won't forget this, Collins." Carl stared at John. "I won't forget any of it."

"Are you threatening me, Carl?"

"I don't threaten, Gibson. I don't have to. I merely state facts." He nodded towards Collins as Janson hobbled into the passage. "He will see to you, sergeant. Join me at H.Q. when you've finished."

"Yes, sir."

Silently, the young doctor led the way into his office. Sally stared after him, then at the retreating back of Carl.

"They mean to make trouble, John, you know that?"

"I know it." He didn't remark on her use of his first name. "Let them try."

"You have a plan?"

"No, I'm not much good at making plans, Sally, but everything will come out all right in the end." He smiled at her; then, as he saw the fine beads of moisture glistening on her forehead, lost the smile to a sudden frown. "Sally! Are you ill?"

"No." She struggled to hide her pain, struggled and failed. "It's nothing, I'll be all right."

"Let me examine you."

"No, John, please." She blushed as she stared down at her hands. "I'll see Doctor Fenshaw."

"You promise?"

"Yes, John. I promise."

He smiled down at her, gently touching her sallow cheek with the tips of his fine, surgeon's hands and, for a moment, something of their old intimacy returned. A fragment from the past when she had been radiant with the beauty only love can bring and the two of them had run from reality into a sparkling world of make-believe.

A world later lit by the fury of exploding atoms.

Staring at her, he felt a sudden tenderness so that, for an instant, he felt a desire to take her in his arms and comfort her. Almost he did it. Almost he managed to shatter the barrier they had built between them; then, as he hesitated, she turned away and the moment was past.

He did not see her tears.

Fenshaw had been drinking but he wasn't drunk. He stared at her over the rim of a cracked mug, gulped the unappetising brew it con-

tained and slopped more of the crude, home-distilled spirit into the container. He was a big, cynical, foul-mouthed man and, because of experiences which he never talked about, had an ingrained disgust of everything human. Now he looked at Sally and waited for her to speak.

"Doctor Gibson said that I should ask you to examine me."

"What's the matter? Can't he do it himself?"

"I didn't want him to examine me."

"So?" Fenshaw gulped at his liquor. "Why not?"

"He's too busy, and Carl has been making trouble again."

"Carl's a cocky little swine who wants cutting down to size." Fenshaw pushed away the mug and leaned forward on the table. "I heard the row out there, and I know all about our little Carl. Give him a gun to play with and he thinks that he's got the world by the tail. Let him push a few morons

around and he thinks that he's God." He spat. "That in Carl's eye."

"He's got a lot of influence. Most of the people are only too willing to obey him."

"Sure they are. They'd be only too willing to follow anyone who did their thinking for them. It was cretins like that which ruined the world." He burped and reached for the bottle. "One day I'll settle Carl for good."

"How? He's armed, and so are his men."

"And a gun is power, eh? Is that it?" Fenshaw snorted. "Well, I've got power, too." He fumbled in a drawer and grinned as he found what he was looking for. "See? Nice and bright and shiny. Loaded in all six." He sobered as he stared at the revolver. "I don't suppose that I'll ever need the other five."

"Please, doctor. Put that thing away."

"Yes." He dropped the pistol back into the drawer. "Handling guns can be

dangerous. They make a man think that he's a God, with the power of life and death. Nasty things, guns, but they have their uses." He looked at the woman. "Well? Do you want me to examine you or not?"

"Just tell Doctor Gibson that you examined me. He may worry about it unless he knows that it has been done."

"So that's it. Who do you think you're kidding, Sally? I may be hitting the bottle lately, but I'm still a doctor and I can tell when a person is ill. You're ill both mentally and physically. Why don't you want John to know?"

"Please." She made as if to rise, then winced as he caught her hands. "Don't! You're hurting me!"

"Then sit down and listen, this nonsense has gone far enough." He waited until she was seated. "First, the mental trouble. What happened, Sally? Did you sneak off together and wake up in your love-nest with the

world in flames and his wife a roasted corpse? Was that it?" He nodded as he stared at her. "I thought so. But you can't wash out the guilt that way, Sally. So what, if his wife did die while you were having fun? Is that bad? If he'd been with her he would have died, too."

"Don't!" she pleaded. "It was like a judgment."

"Religious?" Fenshaw shrugged. "That would make it worse, but Sally, that's all over now. And what about John? Don't you owe him something, too? Damn it, girl, the man needs you. Why don't you give in? Can't you see that he's in love with you?" Fenshaw gestured towards the couch. "Take off your things and let's have a look at you."

She had guessed the verdict. Twenty years in a hospital had made her too familiar with most bodily complaints and she had long ago diagnosed her own symptoms. But even then it was a shock

to discover the truth. Fenshaw had been thorough. He had probed and tested, checked and double checked, using all his skill to replace the equipment which would have made the examination easy, and when he was finished neither of them had any doubt.

"It's bad, Sally." Fenshaw stared into a corner as she dressed and, from the tone of his voice, she could tell that he was shaken. "My guess is a malignant tumour in the ovary. If I had an X-ray I'd be certain but, even as it is, I'd stake my life on it."

"Yes." She fastened the last button and stepped towards him. "I thought it was that."

"You knew?" He stared at her, then, obeying some wild instinct to escape, snatched up the bottle and gulped at the spirit. "John?"

"He doesn't know, doesn't even guess. That is why I wouldn't let him examine me."

"But why not? Damn it, Sally, we can operate, save your life. Why didn't you report sick before this?"

"We were too busy, there was too much to do and not enough time to do it in." She flushed beneath his stare. "Don't look at me like that."

"You must have been damned attractive three years ago," he said slowly. "John, too, is still a handsome fellow. Why did you let that thing inside you eat away your vitality? Don't you realise that you've wasted the past three years of your lives?"

"It doesn't matter."

"But why didn't you speak before? Why? You're a nurse, Sally, not a stupid girl afraid of an operation which would save your life." Irritably he began to pace the floor. "Why? Why?" Abruptly he stopped and pointed an accusing finger at her. "Now I know! You both got a dose of radiation poisoning, didn't you? You couldn't help getting it—most of us

did, and if I know you and John, both of you would do what you could to help. Did you?"

"Yes, but we got over it."

"You think you did. That growth must have been triggered off by the radiations." He snorted with impatience. "A judgment! Of course! You accepted the tumour as a judgment and you've been hugging the knowledge to yourself, revelling in your pain and the thought of your approaching death as punishment and payment for your sin. Sin! What's so sinful about two people being in love? You fool, Sally! You stupid fool!"

"It's not that," she protested. "At first there couldn't possibly be an operation. We didn't have the equipment or anything, and then . . . Then it didn't seem to matter. John was so busy . . . I . . ."

"Have a drink." Fenshaw thrust the mug beneath her nose and passed her his handkerchief. "Wipe those eyes and act your age. Damn

it, Sally, I haven't seen a woman cry like that for years. So you didn't care about dying because you thought John blamed you for his not being with his wife when she died. Rubbish! I'll bet he's been eating his heart out waiting for a sign from you! Men don't miss what they don't want, Sally, not when they've got what they really need."

"You think so, Sam?"

"I know so. Now swallow that muck and pull yourself together. We've got to do something about this."

"No."

"What do you mean, 'no'? Are you going to act silly again?"

"It's not that." She smiled as she wiped her eyes. "Leave it for a little while. John has enough to worry about with Carl and Collins acting the way they are. Don't let us give him something more to worry about."

"You haven't got long, Sally," said Fenshaw seriously. "The quicker we

operate the better chance we have of curing you. Delay will only make matters worse; you've almost waited too long as it is."

"I know. I'll tell him."

"If you don't then I will."

"I'll tell him, Sam. I promise."

He stared at her, letting his imagination clothe her wasted body with firm, resilient flesh, fill the hollows of her cheeks, smooth the lines of fatigue and pain from her too-white features. He glossed her hair, touched a sparkle to her eyes, coloured her lips and dressed her as a woman should be dressed. He stared at her until she flushed and then, after he had seen what she had once been and could be again, turned to the numbing euphoria of the bottle.

He didn't hear her leave the room.

JOHN WAS ALONE IN his office when Carl came to see him. He looked up as the young man entered and

frowned at the hovering figure of Janson standing just behind his master.

"Carl. What do you want?"

"I want a talk with you, Gibson. I think that we'd better have Collins in here, too."

"And Janson?"

"Janson can wait outside." Carl jerked his head at his sergeant. "Send Collins in here and stand by."

"Yes, sir."

They waited in silence until Collins entered, closing the door quietly behind him, and from the young doctor's expression John knew that Carl's presence was no mystery to him.

"Let's get this over with." Carl gestured Collins to a chair and stared at John. "Two days ago we had an argument as to whether or not you should give priority to my sergeant. I told you then that I'd do something about it. Well, here I am."

"I can see that," said John mildly. "With armed guards?"

"Never mind that. What does matter is the way you run this hospital. I know that you've done wonderful work here, Gibson, and I'm grateful to you for it. We are all grateful, but the time has come to be realistic. You know what I'm getting at, I suppose?"

"You want me to refuse treatment to all chronic cases and incurables. You want me to select those who shall benefit by my skill." John shrugged. "I've had all this from your disciple and, to be frank, I'm getting fed up with it. The answer is still no."

"You refuse to co-operate?"

"If that's what you call it, yes."

"I see." Carl stared down at his boots. "Listen, Gibson, this isn't just a lot of talk I'm going to give you, it's the bare truth. You know that I've swept this area from edge to edge. I've searched every square yard and collected everything that could possibly be of use. It

wasn't too hard a job—the area isn't that big, but the point I'm making is this—we have all that there is to be had in this part of the country. There may be others living beyond the contaminated areas, there probably are, but we can't be certain of that. As far as we are concerned this area is all that is left of England—and we are the sole population."

"So?"

"So we can't waste anything. We daren't waste anything. To survive at all we've got to be ruthless, merciless, cruel to be kind, hard so that our children and their children can have something left to call their own. What we do now will determine the fate of a nation, England. What we do now will be our children's heritage."

"You don't have to convince me," said John coldly. "And I suggest that you save your rhetoric for a more receptive audience."

"All right. You want facts, here they are. We can't

feed the old folk. We can't take care of cripples and those with chronic illness. We can't replace your drugs and medicines. If a man is too badly injured, then he must die. If a man is suffering from a disease, then he must die also. We cannot afford mercy, Gibson, not if we are to live and grow."

"I know what you're getting at, Carl, and I warn you, I don't like it."

"Like it or not, you'll do it. From now no cases will be treated which you cannot cure. Workers and essential members of the community will have priority for medical treatment. That makes sense, doesn't it? If you can get a worker back on his feet then he can help to grow more food to feed you. While you obey the laws of the community then you will be supported in everything you need. Refuse, and . . ."

"And Collins will take over the hospital." John

stared at the young doctor. "Is that right, Collins?"

"That's right," snapped Carl. "Well?"

John ignored him. He stared at Collins, and when he spoke his voice held an amused contempt. "I told you once, Collins, that I was neither stupid nor blind. When are you going to begin thinking for yourself? Has the lust for power blinded you to the obvious? Suppose Carl here gets his own way, what then? Kill off the old people—and destroy their hard-won experience. Refuse treatment to the scholars and thinkers—and breed a slave state of obedient workers. Destroy, by neglect if you like, the offshoots of the human race, the idealists, the dreamers, the weak-bodied but strong-hearted, the infants who are slow in developing, the women and boys who, while unable to dig a field, yet could carry within themselves the seeds of a successful mutation. Where do you stop, Collins? And most im-

portant of all—*who is to choose?*

"Who is to decide the ones to receive treatment? Carl? He will pick brainless brawn. You? You can't. You have too much knowledge. You know that a spot on the skin can mean death while a shattered pelvis can be healed. Who is to judge? And what of the future? Eliminate the ailing and, as we are now, you have nothing but morons left. A few of us came from the cities; some of us are intelligent. The rest? Peasant stock. No harm in that, of course, but you know what will happen by intensive inbreeding. We shall multiply, yes, but into what? But all that is unimportant against the overriding question. Who is going to decide who shall live and who shall die?"

"We shall use common sense," gritted Carl. The legs of his chair thumped against the floor as he jerked to his feet. "Enough talk. Are you going to co-operate or not?"

"I . . ." John broke off,

staring towards the door as it slammed open and shut again. Fenshaw stood there, his face red and mottled, his eyes glazed, his lips writhing and flecked with foam. Fenshaw, raving drunk and semi-insane.

Fenshaw with a gun.

He snarled like an animal as he stared at them, the pistol firm in his hand, the knuckle of his trigger finger white as it pressed the curved metal.

"I heard you," he said. "These walls are thin and I heard every damn' word. You!" The gun swung towards Collins. "Sell John out, wouldn't you? See him break his heart so that you can hang onto the tail of this . . ." The gun jabbed towards Carl. "This swollen-headed would-be dictator."

"Put down that gun!" rapped Carl. "Put it down I say!"

"Go to hell!" Fenshaw grinned as he stared at the young man. "What's the mat-

ter, sonny? Someone not doing as they're told? Why don't you drop a nice big bomb on them? You know, kill their women and kids to teach them a lesson. Well? Why don't you?"

"He's gone mad," whispered Collins. "Stark, staring mad."

"I heard that." Fenshaw spat towards the young doctor. "Mad am I? Well, maybe I am, but I'm not too mad to see what's happening here. It's the same old story, isn't it? Do as I say—or else. We've lived by that rule for too long now, we've always lived by it, and look where it brought us. But it's not going to happen again, sonny, and you know why? Because I don't care if everyone dies. Because I don't care if I die. Because I'm going to kill you."

"No!" Carl backed away from the menace of the pistol, his face turning sickly white. "Janson! Help!"

"Your soldier-boy's asleep," said Fenshaw gently.

"I rapped his skull with the butt of Sally here. Why do I call it Sally?" He frowned and shook his head. "Never mind, Sally's as good a name as any. What was I talking about? Death. That's it, death. Your death, you little swine you. Ready?"

"No!" Carl pressed back against the wall, his hand fumbling at the holster at his side. "You can't! You mustn't! You're a doctor, you're supposed to save life, not take it."

"I've saved too many lives in the past, me and those like me. Remember, John? Remember all those fat statesmen with their ulcers and rotten hearts, their tumours and stinking kidneys? We kept them alive too long. We let them play with their toys when they should have been feeding the worms. No, Carl, my son. Not again."

"For God's sake stop him!" Carl dragged at the weapon at his side. "Help!"

"In the belly, Carl," said Fenshaw lovingly. "Right in your stinking gut."

They fired together, Carl jerking back the trigger of his machine pistol and holding it there as lead spouted from the muzzle. Fenshaw fired calmly, deliberately, once, twice, his heavy revolver bucking in his hand; then, slowly, a peculiar expression on his face, he sagged and fell.

In the silence Carl's screams sounded startlingly loud.

"Fenshaw!" John sprang forward, staring down into the fading eyes of the dying man. "You fool!"

"No, John, not a fool, and anyway, I wanted to go." He coughed, blood gushing from between his lips. "Something I must tell you. Sally . . ." He coughed again and John stooped lower.

"What about Sally?"

"She's dying. Malignant tumour of the ovary. You've got to operate. She loves you, John. Loves you . . ."

"Fenshaw!"

But Fenshaw was dead.

Collins looked up from where he stooped over a

bloodstained figure on the cot, his face a twisted mask of worry.

"He's in bad shape, John. We'll have to operate if we're to save his life."

"Damage?"

"One slug ripped through his side, that isn't too dangerous, but the other penetrated the stomach, and I think lodged in a kidney. Unless we get to work on him he'll die."

"I see." John stared at the shelves surrounding the room and gestured to Collins to join him. "Look here."

"Where? What's the matter?"

"When Carl cut loose with his machine pistol he did more than kill Fenshaw. His stray bullets smashed most of our drug ampoules and, worse than that, he punctured the cans of ether. We've just about enough left for one long operation."

"As long as there is enough." Collins gasped with relief. "Carl gets it, of course."

"Why, 'of course,' Collins?

Sally needs it, too. She's suffering from a tumour which will kill her unless we can take it out."

"Sally?" Collins blinked then bit his lips. "Is that true?"

"Yes. She admitted it and Fenshaw told me just before he died."

"I see." Collins stared down at his hands. "Look, John, I like Sally, you know that, but this thing is more important than personal likes or dislikes. Carl is needed. I know that Sally is needed, too, but Carl is indispensable. I'm not exaggerating when I say that, John. Now and again in the course of history a natural leader is born and Carl is such a man. He is strong enough to be ruthless, and he is the only man who can set England back on its feet again. Unless Carl lives, John, there will be no hope for us. There isn't another man in the community who could take his place. If he dies then we'll revert back to anarchy and the beast."

"What are you trying to say, Collins?"

"You've got to save Carl. You've got to!"

"And Sally?"

"Let's be reasonable, John. Sally is too old to bear children now and, in that alone, she is disqualified. We must look to the future, John, not the past. Sally has had her life, but Carl can make life possible for generations yet to come." He stepped forward, his hands extended in mute appeal. "I can't operate, John, I haven't the skill. You can. In your hands rests the destiny of England. Literally. Save Carl and the nation can recover; let him die and we revert to savagery. Need I tell you what to do?"

After, when the thing was done and he had washed the stains from his hands and

arms beneath the still-running faucet, he had time for regret. But, strangely, he felt none at all. The thing was done, his future decided and, as he dried his hands and walked towards the bed on which lay his patient, he felt a quickening anticipation.

He smiled and his smile was answered. He knelt and arms closed around his neck, arms which drew his head towards lips that had once been soft and would be so again.

He didn't think of Collins, of the man's desperate pleadings and frenzied threats. He had made his decision and, as he kissed the woman he loved, he felt a strange peace.

After all, he wouldn't be the first man to have thrown away a world for the love of a woman.

A life and a marriage was saved when there was—

A Hitch in Time

by ANTHONY G. WILLIAMSON

TIME TRAVEL'S A QUEER business. You start out from a room that looks a cross between the Atomic Pile at Halford and the complicated part of a mechanical nightmare, and then, with only the nauseating plunge of the projectors, land right smack in the middle of another nightmare—only this one is a little more realistic than the classic mode. I'd gone in for it as a lark, not knowing what to do and having a couple of hundred thousands pounds to do it with, and finished up by being a time travel vector operator.

A T.T.V.O.'s job is a complicated one. Apart from having to usher gawking customers from one period B.C. to another, he has to know exactly what is going to happen and be able to extricate his charges from any awkward situation which may arise; like the young lady who fell in love with a crusader and couldn't understand that by settling down with him she'd probably find herself spread around in two thous-

and different people . . . all non-existent anyway!

Confusing isn't it?

When I was one of the youngsters at Time Tourists Ltd. I was given sector one. This sector existed in the hot, tropical period of the "before-man-wore-trousers" era, simply crawling with prehistoric animals that the most eminent zoologist refused, at first, to believe, finally admitting that their drawings and theories for the past few hundred years "might" have been slightly wrong. Of course there was the brontosaurus, dinosaur, pterodactyl and mammoth, but their habits did not conform to the specified pattern and their neighbours seemed rather out of place.

But I won't bore you with details. This was my sector, and after months of arduous "time study" I was finally given my first party, an old fellow who had become senile enough to want to shoot a real live mammoth. For myself I would have preferred a week in ancient Rome during one

of their particularly "wild" holidays, but then maybe I'll make it yet.

I picked him out an old bull, about twenty feet high and quite ferocious to look at, although it was about to die of old age five minutes after we got there. He didn't know that, of course, just thought it was having its afternoon nap. Wearing our protective suits of rubber, and breathing "canned" air, I led him up to within fifty yards of the brute and let him have his high-powered automatic rifle.

The mammoth looked at us with weak and watery eyes, and made a valiant effort to scramble to its feet; whereupon the old man gave a squawk of terror and fired about fifty rounds into various parts of the animal's anatomy before jamming his weapon and turning to me with terror-stricken eyes. Calmly I ejected the jammed cartridge, fired three shots into its right eye, and prepared to take the trophy pictures.

Not all my trips in this sector were like this, some providing days of careful stalking and finishing with a hefty battle in which my party usually gave a good account of themselves. But the most serious case was that

of Mr. and Mrs. Nick Lestrangle.

It was a three-day trip, our vector being set for removal after that period, and we had three full days in which to track across the dry burning plains of what was then the central continent of the world. This area was my gold mine. Here we could shoot as many animals as we liked without distorting the time continuum, for a mere two million years after we left it vanished beneath the seas and could never have any direct effect on the evolution of the world. Consequently, I reserved it for special customers—the only thing special about them being a bank account of the "very large" size, and a strong inclination to pay scandalously for the rather dubious pleasures upon which we embarked.

Nick Lestrangle was like that, and Gloria, his young and beautiful wife, didn't want to stay at home either. We were after sabre-toothed tiger and, complete with land-rover and high velocity standard hunting weapons, we were projected, one blazing hot morning, into a desert of ash and short dry grass. Almost immediately I began to get complaints. Their suits

weren't refrigerating enough, their air supply seemed clogged, why did I have to drive over so many pot holes? I took it all, beginning to think that here was another pair of "fish" who would run before we got within a mile of our prey. They soon settled down, however, and as the day wore on things began to look a little brighter.

Nick was a big man in his late thirties, with a bluff and hearty manner which could, at times, become irritating. He sat in the back of the land rover, gun across his knees, watching the terrain with squinting eyes, whilst Gloria, with her slim figure and shining blonde hair, sat chattering merrily next to me. I was happy, he was happy, and she seemed happy enough. Anyway, until we saw the first one.

There aren't many animals on the plains; a few slow-moving saurians, the occasional bat-winged bird, and, of course, the sabre-tooths. It was just before noon, whilst we were setting up the table for the afternoon meal, that he came loping out of the mile long clump of brush that extended away to our right. He was big—all sixteen feet of him—and at first I thought

Mrs. Lestrangle was going to have hysterics. After groaning once or twice as though someone had just stepped on her best hat, she went a sickly yellow and began to run madly for the landrover.

"There he is," I said, unnecessarily, to Nick. "Bag him."

But, after a moment's agonised stare, he was running frantically after his wife, looking a bit sheepish when she climbed into the rover and yelled at him to shoot the damned thing and then we could go home. Pulling out my frequency whistle I spent a casual moment adjusting it, whilst the pair watched fearfully, and then blew it as hard as I could. The tiger, only a hundred yards or so away and coming like an express train, slid to a stop, shook its head, tried to come a bit nearer, and then bounded away with a howl of disgust.

"What on earth did you do?" asked Gloria, face pale.

"Sonic vibrations, we all have them in case we're attacked by something we aren't allowed to shoot."

Looking slightly embarrassed, she turned to her husband. "You wanted to shoot a sabre-toothed tiger! Your one ambition in life

was to shoot one whilst it came at you snarling and roaring. You could hardly wait to come on this trip. Well you just had your chance!"

I really felt sorry for him.

"Took me by surprise," he explained, red faced. "I'll get it next time."

"Took you by surprise." She slid off the vehicle, and with a final disgusted glance, came towards me, looking extremely pretty in the close-fitting suit and general air of indignation. "I'll help you get the meal ready, Tony," she smiled. "Perhaps you'll take me hunting this afternoon? Now that I know you've got that little whistle I feel much safer." With a pointed glance at poor Nicholas.

We spent the afternoon roaming the bush, shooting a couple of animals that were probably the prototype of the present-day gazelle, and returning to the camp as the sun began to set. The pair of light-weight tents were soon erected and, using a reactor, I quickly had a cheerful-looking blaze that was a passable imitation of a camp fire. Over this I cooked the thin juicy steaks, the remainder of the courses coming steaming hot from the food packs, but nevertheless

making a very satisfactory meal.

Nick was out of favour with Gloria, and I soon saw that by both vying for my attention and completely ignoring each other the atmosphere was going to be fraught with peril for yours truly. Apparently the trip had been taken as a last attempt to save a disintegrating marriage, childlessness and hair-trigger tempers making life rather hard for the pair. After two hours of painful conversation I suggested that we retire for the night, and with sighs of relief they went into their tent.

I'd been in bed for an hour or so, unable to sleep and doodling thoughtfully on my report sheet, when the double flap of my tent opened, allowing a small amount of air to enter and promptly starting the disinfectors, killing off any unnecessary bacteria that had arrived, and with surprise I found Gloria, delightful in white silk dressing gown and radiant smile.

"I couldn't sleep," she said, taking off the transparent air mask which is an essential when travelling in four million B.C.

I nodded, not missing the discarded mask and wondering whether I should jump out

of bed and offer her a seat. "I'm not very dozy myself." "Nick's asleep!"

There was a small pulse beating rather rapidly at her neck and it was beginning to get extremely hot in the tent. "Lucky fellow," I said awkwardly.

"He's a fool!"

I waited. It was the old story, only somehow I hadn't expected it from Gloria, with her sweet face and clear blue eyes. But she was lovely, and . . . well, if her husband couldn't keep an eye on her, who was I to argue!

"He's a fool and a coward. Look at the way he ran today, and yet he could talk of nothing else for the last few weeks but of how he was going to shoot a sabre-tooth. Why do men have to act so much? Why can't he just relax and be himself?"

I wasn't quite sure whether to be annoyed or pleased. This wasn't the way it should go. Tears definitely didn't come into it. No-good husband—yes. Doesn't understand me—certainly. "You're so . . . so capable"—an absolute must. But there she was, standing in the middle of the floor, looking miserable and about to burst into tears.

"Maybe if he thought you

loved and admired him he wouldn't have to act?" I suggested.

She came and sat on the edge of my bed. "Do you think that's where I've gone wrong?"

I felt like looking around for the pipe and beard. "Could be."

"Oh, but it's too late. I saw that today. I felt nothing but disgust . . . and loathing for him."

She was crying now, and awkwardly I put my arm round her shoulders and tried to comfort her. At the back of my mind a cynical little man was laughing at me. Here was I, sitting up in bed, comforting a beautiful young woman and explaining how to become happily married to her "husband." A T.T.V.O.'s life is a strange and trying one.

"Why don't you run back and sleep on it?" I said. "In the morning you'll probably feel quite different about things."

She raised a tear-stained face. "You know, when I first came in here I . . . I was going to let you make love to me!"

"It's never too late," I said, cheerfully, but it was an empty gesture. The moment had long since gone; she saw that and left soon after with a

promise to try and make a go of it the following day.

Morning dawned, a rosy red paradise with the air so clear and the bush that held our prey a brilliantly hued jungle from which came strange and fascinating sounds. Surreptitiously, I took down the energy screen I had erected the previous night, not wanting them to think they were being molly-coddled, and got the steaks frying over the fire and an assortment of cans slowly heating in their chemical coffins.

Nick was first out, face bright and looking capable of tackling a sabre-tooth bare-handed as he swung his arms vigorously in the sharp morning air. We laughed over a joke or two, and when Gloria came out I watched her cautiously and wondered if last night had made any impression. Going over to Nick, she kissed him merrily through the plastic envelope of her mask, and with a sigh of relief I got on with the breakfast.

The change in Nick, after Gloria's affectionate greeting, was miraculous. The three of us went into the brush and he was not only leading the way, but actually hoping we sprung a sabre-tooth. As we began to get deeper I moved him back a

bit and took the lead myself, not at all as confident as he was. Threading our way through gnarled and twisted trees, hanging veils of vegetation, we finally sprung a fearsome brute that—if it had breathed fire—would have passed for a dragon in any man's book.

But Nick, with astonishing agility, jumped to one side and in a flash was blazing away with his powerful automatic. I stepped back, letting him have the show as he stood—Saint George had nothing on him—and brought the animal crashing down with a roar that shook the very earth.

Photographs taken, we returned to camp, Nick jubilant, and Gloria still a little pale, but smiling happily at him. It was as we broke from the bush that the trouble started. Like a fool I had forgotten to put up the energy screen before leaving camp, and the immense shape of a sabre-tooth was engrossed in the interesting task of ripping our tents to shreds. Gloria had fallen back and was talking eagerly to me about the photographs we had taken, and before I could stop him, Nick had sprung forward with a shout of triumph and was running towards the camp.

I called him back, but he

took no notice and, with a curse, I started after him, Gloria shouting fearfully as the sabre-tooth glanced up from his task and slowly took in the scene. Sabre-tooths are no easy game, and although Nick had his rifle at the ready, I wasn't any too sure of him. Perhaps it was the success of the morning, perhaps a show of courage for Gloria, but he was running towards the tiger with a marvellous disregard for the fact that it could cover the ground at something like eighty miles an hour.

He had covered only half the distance, when it began to run towards him, body crouched, tusk-like teeth gleaming whitely in the sun; and at that moment his foot hit a rock and sent him sprawling to the ground. Quickly I reached for the whistle, only to find, to my horror, that I had left it in the shirt I had changed that morning. Kneeling down, I brought up my rifle and began to shoot, carefully and calmly, at the charging beast.

I had run to one side of Nick, so I could see his face plainly. He was as white as chalk, only now realising the stupidity of his move, and rising to his feet he began to fire rapidly. The distance I was

firing at was not good, but even so I could see puffs of dust flying from the tiger's shaggy coat and knew that it could only be a matter of seconds before it dropped. But in a matter of seconds it would be upon Nick!

Gloria was screaming shrilly, and from the corner of my eye I saw her bring up her rifle and start shooting erratically at the charging tiger. I was too busy to realise that Nick was in her line of fire, until suddenly he stiffened, spun round and fell to the ground. At the same moment I put three more bullets into the sabre-tooth and watched it fall heavily, dead before it hit the ground.

With a sick horror inside me I went towards the crumpled body of Nick, knowing it was useless to try and keep the running girl away. Crying hysterically, she dropped beside him. He was dead. Shot in the back; and with my mind racing over time, vector medium, displacements, I couldn't afford to comfort the pathetic figure at his side. There was only one chance.

Quickly jerking out the recall signal, which we all carried in case of emergency, I snapped over the switch and,

with a nauseating plunge, found myself back in the projecting room. Jim Summers was working the platform and regarded me with amazement.

"Something wrong?"

"And how. I'll want a 'retake.' Chief in?"

He nodded, face blank as he already flicked on the emergency generators and set the alarm echoing through the mighty building of Time Tourists Ltd. But I was on my way to Mark Garthway's office at a run. Garthway was the director of the company, a man about to blow his top in two minutes.

"Yes?" he barked, glancing up from behind a wide expanse of mahogany.

"I want a 'retake,'" I said as calmly as I could.

The cigar jumped from his mouth. "Are you crazy?"

"No, and it's got to be done in the next five minutes. If not you've got a dead Nick Lestrange on your hands and God knows how much in law suits and insurance."

"Dead!" he exclaimed, face paling. "How?"

"Wife, shooting wild in hunting scrape. Nothing I could do. It'll have to be a 'retake'."

"You're prepared to take the risk?"

I nodded, mouth dry as I tried not to think of that risk.

"Right. It'll cost us ten thousand in power alone, but if you think you can do it, it's your skin." He said it grimly, voice like metal grating on wood, but I knew the chief. He was with me, even though he might not show it.

Back in the operating room Jim had already got the equipment set up and the room was filled with the high scream of the generators as they droned out enough power to blast the entire city of London. Anxiously I waited for the beam to become powerful enough to probe back into my sector, wondering if we would be in time to catch the fading impressions.

A "retake" is a suicidal device which was evolved for the purpose of probing into the different time sectors in order to undertake time study, but on rare occasions it had been used to project T.T.V.O. men in an endeavour to duplicate a sequence of events and possibly change them. The majority of these attempts had finished with the obituary of the T.T.V.O.

The idea is that the probe picks up the impressions of

the T.T.V.O., which fade very quickly due to the shortness of his stay in the past, and project him again into his body—already there—with a full knowledge of what is going to happen and consequently the capacity to change the ensuing events. "It pays not to try and think about the maths of it." But the big snag comes if the projector operator doesn't quite hit the target and we have two identical bodies both existing in the same time. Then there is one unholy mess and bits of the T.T.V.O. are scattered from the year dot to the year apostrophe.

Jim Summers was my friend and I had the fullest confidence in him, yet the pictures that were flicking through my mind were not pretty, and by the time the screen lit up with a view of my sector there was a nasty hole where my stomach should have been and the sweat was a cold, moist blanket on my face. Quickly I climbed onto the platform, rifle held ready and cocked to fire.

Slowly, terribly slowly, the probe brought the picture of the plain, the long wall of bush, the camp and the sabre-tooth tearing up the tents. Jim's face was strained and rigid with concentration as the scene slowly evolved, like

some old silent picture of the past.

"As soon as we come jumping out of that bush, throw me through." I said hoarsely.

"I'll try and get you in your own boots," he answered, not looking away from the screen.

"You'd better. I'm too old to be twins!"

Two assistants were spraying me down with various vapours to ensure that I would carry nothing back with me that I hadn't arrived with, and with straining eyes I waited for us to break through the wall of bush. It was Nick who came into view first, and then he was gesticulating and running towards the tiger. With beating heart I watched the picture slowly dwindle until I was the only figure on the screen, and slowly Jim's hand was inching towards the projector switch. For a fraction of a second I had the curious thought that this was a damned silly position for me to be in, when I could just be working out the insurance and law suit damages with Mark. And then there was the plunge, blackness with flickering dots of coloured light, and a shock that took every bit of breath from my body.

The sound was terrific, Nick on the ground, the

tiger roaring and charging across the fantastically short distance, and in the madness I found myself running beside the girl with the rifle clutched in my hands. A quick glance round showed that I was alone, no twin to mess the works up, so with a burst of speed I swerved back to the girl and grabbed the rifle from her hands.

I didn't stop to explain, although her startled face showed that there would be some explaining to do later, but swerving out again I plunged to my knees and began to fire at the charging beast. Nick was already firing and, with a prayer in my mouth, I watched the dust flying from its coat, each lithe flying leap bringing it closer to the white-faced man whom I had just saved from death. But the three seconds it had taken to snatch the rifle could mean the difference between Nick and the tiger.

The day was made hideous by the screams of the wounded tiger, the wicked spang of the quick repeating rifles, the sobbing cries of the girl. And then suddenly everything was quiet again, and Nick was walking forward with a smile of triumph and Gloria was running after him with a look on

her face that said she'd never take the chance of losing him again. I stood and watched them for a while, breathing deeply and giving Jim a grateful wave of my hand—just in case he was watching. It was good to be alive.

That's more or less the end of the story. We spent the next two days roaming about camp until the vector pulled us back, but the Lestranges were a little too wrapped up in each other to spend much time with me. They were probably quite amazed at the enthusiasm with which we were received back at Time Tourists, but then Jim and I had a secret that we had to go and get drunk over.

Of course they never knew what had happened, but I often wondered afterwards if somehow Gloria hadn't retained a little of that picture I will never forget. Her tear-stained face, white with horror, bending over the dead body of her husband. I suppose it *could* be possible, for she looked long and thoughtfully at me when she said goodbye, and as they went out her hand was holding tightly to Nick's.

But then, of course, it didn't happen, anyway, really . . . did it?



Find the Editors!

THE DRAWING ABOVE IS AN IMPRESSION GAINED BY ARTIST "ATOM" when he visited our Editor's hotel room one evening during the recent Science Fiction Convention held at Kettering.

People in the melee include some of Britain's most famous science fiction writers, world-wide-known fans, and at least one rival editor. Talk is fast and furious, kept going by a fund of lubricating fluid supplied by members of the London Circle.

How many personalities can you recognise? and most of all, *can you find the Editors?*

Sometimes, unbelievable things happen—

DOWN IN OUR VILLAGE IN SOMERSET

by G. B. TAIT

REMEMBER BIBBINGTON Parva...? That's right—the village where the flying saucer was supposed to have landed about three years ago.

Of course, nobody believed that yarn even for a moment. Perhaps there have been such things as flying saucers. They may even have landed somewhere on this planet. In France, perhaps, or China, or in one of the wilder and more sensational parts of the U.S.A. But in England, no! In Bibbington Parva, impossible!

It was never discovered how the rumour got started. Certainly it seemed most unlikely that anyone in the village was the culprit, because the entire village to a man—and woman, and boy—was solid in the opinion that the whole affair was utter nonsense.

And you will remember that the local people were not by

any means the bearded, besmocked yokels of the comic stories. Besides the doctor, there was Professor Cornwall, a retired University man; Eric Wintringham, a writer of some repute, and two or three of the modern sort of farmer, the kind who know all about tractors and can make cows produce milk and hens lay eggs by electricity. Above all—if you want a source of carefully observed and accurately stated fact—there is Constable Joseph Yulebottom, the village policeman.

Thus, although the rumour started energetically, flourished exotically and reached the national newspapers, nobody ever traced it to its source; those people who might be expected to confirm and amplify it, continuously denied its truth, and thus it died prematurely after ten days . . . And yet the

story was nothing more than the exact sober truth.

There were five of the boys together that day—David Cornwall, grandson of the Professor, aged thirteen; Scottie Niven aged ten, his cousin; the two Maltby brothers Billy and Tom (ten and eleven respectively); and there was Butch who was four. Butch was an orphan. His parents had been killed in the war and he lived with his aunt.

They were out at the marl pond hunting wild fowl. There were a few of the birds over at the far side of the big pond, and the Maltby brothers, who were farmer's sons, and well trained in country tricks, were trying to move them nearer.

They had powerful catapults made from rubber gas tubing and were firing long-range dropping shots which fell beyond the birds. Every time a pebble plunked into the reedy marsh beyond them the wild fowl stirred uneasily and moved outwards. David Cornwall, who was of a tranquil

turn of mind, lay on the high bank watching. Butch, a bundle of uncontrollable energy who feared nothing and no one on the face of this earth, ran back and forth along the shore of the pond, shouting insults at the birds and occasionally trying to lift big boulders to throw at them.

The spaceship made no great noise when it arrived, just a small whistling sound. It came down onto the common land on the far side of the pond. When it was only ten feet above ground its forward speed was checked and it descended vertically and quite slowly. It sank out of sight into a hollow among the gorse and bracken.

All the boys got a glimpse of it before it disappeared. Butch danced up and down and pointed and screamed with excitement and cried: "Wozza? Wozza?"

The others remained calm. They had learned all about spaceships in the strip cartoons and science fiction

magazines, and the television programmes.

"It's a spaceship, stupid," Tom Maltby told him.

"What's a spaceship?" Butch asked, gazing up at Tom.

"It's a ship that comes from Mars, filled with monsters with long tentacles to eat you up."

"Monsters?" Butch asked. "I'll not let monsters eat me. I'll killum. I'll killum all." He grabbed the catapult Tom Maltby held, wrenched it from his hand and darted off, his short legs twinkling, along the path that would lead him round the end of the lake.

"It didn't look much like a spaceship to me," Scottie objected. He was rather inclined to be disparaging about everything that happened in England. "I didn't see any rocket motors," he added.

"The best sort of spaceships don't use rocket motors, silly," Tom Maltby scoffed. "They use space-warps."

"My father says space-warps are nonsense," the hard-headed Scot replied.

"They're not."

"If they aren't nonsense," the Scot demanded, "tell me what they are and how they work."

"Suppose we walk round and see for ourselves," David suggested.

"We'd better—Butch will probably have fallen into the lake by now."

They sauntered round to the other side of the lake, arguing loudly about rocket motors, space-warps, and antigravitational plates. They crossed the footbridge over the stream and went along the path among the bracken. They overtook Butch, whose interest in spaceships had been diverted by the sight of a toad.

The spaceship was there all right, lying well concealed in a hollow.

In shape it was something between a very fat round-nosed cigar, and an extremely long thin egg. Its colour was dull silver and there was a great dent across its back. At each end there appeared to be a half-spherical transparent blister.

The thing was only about a hundred and fifty feet long and fifty feet in diameter at its mid point. Altogether it was rather disappointing.

The boys sat in a row on a ridge overlooking the hollow in which the ship lay, and studied it.

Nothing happened.

At the end of five minutes Bill Maltby selected a suitable round pebble, fitted it into the sling of his catapult, and with great deliberation took aim at the spaceship.

"Stop that," David ordered. "Know what happens when you act hostile to spaceships? They blast you with sizzling violet rays . . . There'd be nothing of you left, only a burnt spot on the ground."

"Aw, nuts!" Billscoffed, pulling the elastic and squinting over the V with one eye closed.

"Take it from him," David told Tom.

Tom flung himself on his brother. There was a scuffling and panting for about a minute, then peace was restored.

The boys continued to sit and watch the spaceship for five more minutes, which is a long time for a bunch of lads to sit doing nothing.

"Come on, chaps," Scottie exclaimed at the end of that time. "I thought you were going to show me how to shoot ducks with a catapult?"

They all got up and trooped back to the pond. They spent the rest of the afternoon firing pebbles at the wild fowl but didn't hit any.

At dinner that evening David Cornwall told his grandfather about the spaceship. The professor, who thought he understood a great deal about boys and their imaginative games, listened, nodded gravely and agreed with everything the boy said, but understood nothing.

The Maltby parents belonged to a different school. They merely told Bill and Tom to stop talking nonsense, get ready for bed, and don't forget to do your teeth. Scottie wrote a letter to his

mother in Carnoustie but forgot to mention the matter. Butch talked to his aunt, who was the postmistress, about the toad and about the ducks, and something about the spaceship, too, but she did not listen. As a matter of fact, the boys did not try very strenuously to interest their elders in the discovery. They knew that old people were usually wrong about such things. Mr. Maltby, for instance, had quite recently refused to believe that a delta-winged, dart-shaped aircraft had passed over the village; had in fact denied that such a thing existed.

Professor Cornwall, when he could be persuaded to discuss the subject at all, strenuously denied the practicability of interplanetary travel. The boys found this rather inexcusable, for, after all, the professor was a scientist, though a very old one, and ought to know better. The postmistress, Butch's aunt, considered that television caused rainy weather.

It was scarcely worth while

trying to discuss really important subjects with grown-ups.

The day after the arrival of the spaceship was very wet and the boys stayed indoors. The following morning, however, was fine, and by nine o'clock they had all assembled outside the post office, which was also a sweet shop.

"Let's go and see if the spaceship's still there," someone suggested.

They straggled off down the road. Before they had gone twenty yards Butch shot out of the post office door like a bullet from a gun, shouting: "Butch coming, too! Butch coming, too!"

"All right," David agreed resignedly, "but shut up and behave, else you'll frighten the spaceship away."

For some reason they thought it advisable to creep up through the bracken. The bracken, incidentally, was soaking wet from the recent rain. They parted the leaves and stems and peered down

into the hollow. The ship was still there.

This time they observed a small round door on its side, amidships. It was part-open and a short ramp led down from it onto the grass.

The boys stretched out on their stomachs, elbows on the ground, chins on fists, and waited.

After what seemed to be a long wait—though probably it was not more than three minutes—a man came out of the ship. He was not at all an ordinary sort of man; to begin with, he was only about four feet six high and he wore rather odd clothing; he also seemed to be quite bald and his complexion had a greenish hue. Nevertheless, he failed to come up to the boys' expectation.

"No monsters," Scottie pointed out. "No tentacles."

The green man looked around the hollow and up at the sky, and then went back inside again.

The boys continued to watch.

Presently: "Where's Butch?" Tom Maltby asked.

Butch was nowhere in sight. "We'd better go back to the lake in case he's fallen in again," David said.

Butch was not to be seen by the lake, so they returned to the hollow. They were just in time to see Butch tip-toeing with infinite caution up the ramp towards the door of the spaceship.

"Butch! Come back, Butch!" the boys all yelled.

Butch gave a startled look over his shoulder, then scuttled out of sight through the open doorway. The door swung round and clanged shut.

Without another word the boys raced down the slope towards the ship; then, as they neared the closed door, they skidded to a halt. The door opened again immediately and the green man appeared leading Butch by the hand. The green man looked even more peculiar at close quarters. He was quite green, sure enough, and entirely bald. As a matter of fact, he looked rather like a

pixie who had got in the way of a paint spray, but he seemed friendly, for he merely urged Butch on his way down the ramp with a playful smack on the behind.

Standing in the doorway the man looked down at the boys. They stared back at him for a moment, then simultaneously took to their heels and bolted out of the hollow.

The boys were walking up the lane leading to the Maltby farm.

"We must try to get some people to take an interest in this," David had decided. "It's no use talking to grandpa; we'll have to talk to your dad."

"He's not a lot of good, either," Bill Maltby admitted frankly. "Thinks about nothing but prize rams."

They went into the farmyard and round to the kitchen door—front doors of farms are never used.

"Your father's in the top shed fixing the lighting plant," Mrs. Maltby told them.

They found Mr. Maltby standing in a puddle of paraffin beside the motor that supplied the farm with electricity.

"This isn't going to be easy," David told the others. "Let's try not to get rattled." Then: "Hullo, Mr. Maltby," he greeted.

"Hullo, David! Come to tell me what's wrong with this engine?"

David believed he knew what was wrong with the engine; the paraffin Mr. Maltby used contained a small amount of water which in due course accumulated in the carburettor, but he knew also it would be almost impossible to make Mr. Maltby accept his advice about this. With a self-restraint quite unusual in a boy of his age he stuck to his main purpose.

"There's something we think you ought to know, Mr. Maltby," he said.

"Right-o! Fire ahead!"

"... There's a spaceship landed in the hollow over by

the pond," Tom Maltby burst out.

"Oh, come now . . . You can't catch a wise old fox like me with a tale like that," Mr. Maltby laughed.

David dug his elbow hard into Tom's side to shut him up.

"That's just Tom's imagination," he explained, "but there is an aircraft or something of the sort over by the pond . . . I think you ought to come and have a look."

"Are you sure? I never heard anything come down."

"Got funny green men inside," Butch contributed.

"Green men?" the farmer asked.

"He means greenish clothes," David amended hastily.

Mr. Maltby glanced round at David and saw that the boy was quite serious, even gravely concerned.

"Very well," he agreed. "I'll come as soon as I've fixed this engine. Now I must nip round to the tractor shed for my big spanner."

"Fixing this thing could take all day," Tom commented gloomily.

"Hand me that little spanner. I'll clean out the float chamber," David said.

He undid two bolts and a screwed union and tipped the contents of the float chamber onto the ground. Sure enough there were blobs of water in the paraffin.

"This tube should be emptied, too," he reflected. "There's bound to be more water in the bottom of the bend."

"I'll suck it out," Scottie volunteered heroically.

"O.K. But don't swallow—spit it all out."

The hardy Scot performed the operation without any change of expression and the float chamber was screwed back. They had just time to prime with petrol before Mr. Maltby returned.

"Perhaps it might go now," David ventured.

"Not a chance," Mr. Maltby told them, wisely. "Watch!" He turned the handle once to

suck in, then gave a second quick jerk. The engine fired and kept on firing.

"Well!" the farmer exclaimed admiringly. "I must have fixed it somehow. Question is, will it keep on when I switch to paraffin?"

It did. Ten minutes later Mr. Maltby was walking down the lane with the boys.

David beckoned to Tom. "Nip back home and fetch your father's binoculars."

Tom sped back the way they had come.

They crossed the main road, passed up the lane on the other side, over the stile and along the path leading round by the pond. Here Tom overtook them.

They conducted Mr. Maltby round among the bracken, then brought him round the bole of a big tree so that he came suddenly in sight of the spaceship.

He stood absolutely stock still for a whole minute. Then David pressed the binoculars into his hand. The farmer adjusted them, lifted them to

his eyes and focused them absentmindedly. Just as he had got them to his liking the door of the spaceship opened and two of the green men came out.

"Well, well, I'll be jiggered!" exclaimed Mr. Maltby.

Although he was much too immersed in dull grown-up business and definitely uninterested in the more important and exciting things in life, Mr. Maltby was no fool. He wasted no time trying to convince himself that this was an ordinary man-made aircraft or that these were normal human beings. He looked helplessly at the boys.

"What do we do about it?" he asked.

"I don't know, sir," Scottie replied with grave politeness. "We rather expected you would know." Perhaps there was a very slight trace of irony in his tone.

"Let's go round and talk to your grandfather," he suggested.

They turned and began to walk back the way they had

come. They had gone only a few yards before they heard shouts from up the hillock behind them. The shouts were easily recognisable as the sort of noise that only Butch could produce.

Butch was outlined on the skyline. He was looking downwards towards the spaceship. He was thumbing his nose at the strange visitors and shouting: "Green-belly! Green-belly!"

The boys were crowded into Professor Cornwall's untidy study. The professor occupied his own special chair, Mr. Maltby stood on the opposite side of the fireplace, and Eric Wintringham, the writer, sat in the visitors' chair. The boys had built perches for themselves with piles of books.

The grown-ups had just returned from a joint visit to the hollow and their state of mind was now such that they could discuss the spaceship and its occupants as if they believed in their existence.

"Question is," Mr. Maltby asked, "what do we do about it—if anything?"

"We can tell the newspapers," Wintringham suggested, but not as if he thought it a good idea. "Make one telephone message, then stand by, keep well clear of the subsequent stampede, and let nature take its course."

"And have the village invaded by newshounds?"

"Newshounds?" Wintringham scoffed. "Within three hours the village would be packed solid with cars, the sky darkened with aircraft, the air quivering with the click of camera shutters. Within a week 'bus trips would be arriving from every corner of Europe and within ten days the spaceship itself and probably its occupants as well would be torn to shreds for souvenirs."

"If you write as picturesquely as you talk," Professor Cornwall observed, admiringly, "your books must be quite good. You've convinced us. We must keep this quiet..."

But isn't it our duty to report to the police?"

"Why . . . ? Are any laws being broken?" Mr. Maltby asked.

"About a hundred, I should imagine," Wintringham answered. "Entering the country without passports; operating an aircraft over British territory without a certificate of air-worthiness; making an unauthorised landing; carrying lethal weapons without a firearms licence—I've no doubt they have weapons of some sort—camping on common ground without a licence from the Rural District Surveyor. I expect Constable Yule-bottom could think up a few more."

"What do you boys think we should do?" the professor asked, turning to David.

David's opinion of his grandfather rose at that question. He had definite ideas about what should be done.

"It's important not to let the authorities know," he answered promptly. "In all the stories I've read, the

Army fools around the ship with guns and tanks and things, then some junior officer will panic and fire on the ship with artillery . . . This makes the aliens mad and they burn up all the guns and all the soldiers and the countryside with death-rays . . ."

"I see your point," the professor conceded. "Although I can't agree that any portion of the electro-magnetic spectrum can be lethal. But so far you've only told us what we shouldn't do."

David resumed: "The green men have either come here to make a study of our civilisation . . ."

"To spy out the land . . .'" Mr. Maltby interrupted.

". . . or they've landed to make a repair; I think they're making a repair, for there's a big dent in their ship. Whichever it is they'll take back a report about us to their own planet . . . We ought to make sure the report they take is—is—" He hesitated.

"Favourable?" Wintringham suggested.

"No, I wasn't meaning that." He still hesitated.

"Make 'em want to be friends rather than fight us," Tom Maltby contributed.

"By Jove!" Wintringham exclaimed admiringly, "I get the idea. You know, these pulp magazines you boys read aren't such nonsense after all."

"What's the idea?" Mr. Maltby asked.

"Like this. We must act civilised; that's to say, we must not seem frightened or jumpy; we must be polite, interested, hospitable, good-mannered . . ."

"... Like not calling them yellow-bellies, for instance," Bill Maltby said.

"Didn't," Butch protested. "Called them green-bellies."

"To do that much may not be enough; for the strangers might then say: What ho! Here is a pleasant land flowing with milk and honey; let's move in."

"Judging from your quick grasp of the idiom, I'd say you've read a few magazines yourself, Wintringham," the

professor remarked. "How do you discourage them from moving in on us?"

"We do nothing directly—nothing so crude as offering threats, but we arrange for them to find out that we have a really solid background of technological achievement."

"For instance?" Mr. Maltby invited.

"Invite them to have a look round the neighbourhood . . . Let 'em see a Rolls-Royce, but not Joe Watkins' pony and trap. Show them the Cottage Hospital's new operating theatre—it's one of the best in the country—but not the sewage farm."

"We haven't got a Rolls-Royce," Professor Cornwall objected.

"Oh, yes, we have. My aunt bought a new one last week—cream and black. I'll borrow it."

"The science fiction books have a way of always making aliens think that even the very best we've got, like Rolls-Royces, are crude and rudimentary," David objected.

"There I think they're wrong," the professor disagreed. "It's impossible by any standards to consider a Rolls-Royce crude. It's a perfection of development along a certain line. The Viking galleys were the same in their time—even today we couldn't improve on that particular design of ship. Same with the sailing ship of the 19th century. None of these things can be called crude."

"And then there's telepathy," David pointed out.

"What d'you mean?"

"Stories about visitors from other planets very often make them able to read people's minds and to know what the likes of us might be thinking."

"Ah, yes . . . I've never been certain of the non-feasibility of telepathy. There's a good deal of evidence . . . Still, I don't think alien minds could understand what goes on in ours. Familiarity with the ways in which we think and the things we think about seems a necessary preliminary to their reading our thoughts."

Mr. Wintringham drove the Rolls round the lake to within a few yards of the hollow where the spaceship lay. He and the professor walked to the end of the access ramp. Feeling rather foolish, they called out things like: "I say!" and "Are you there?" This was enough, however, to bring the green men—there were only three of them apparently—out into the open.

The two parties stood a little apart, smiling each in its own fashion, and making hospitable and amicable sounds. The strangers' speech was a quick bird-like twittering.

Eric Wintringham, who certainly must have read some science fiction books in his time, made wide and vigorous gestures of invitation which the strangers could scarcely fail to understand.

Their first reaction was rather naturally one of doubt, but after an exchange of rapid twittering talk, two of the green men indicated that they were ready to accept the in-

vitation. The third went back into the ship.

It was clear they were impressed with the Rolls; touching and pointing, they walked round it, twittering to one another, before climbing into the rear seat together.

Butch, who had been ordered to stay at home and behave, emerged from the undergrowth just as the strangers were getting into the car and scrambled up beside them. The professor and Wintringham had just caught a glimpse of a slender metal rod beneath a loose jacket—no doubt some sort of weapon.

Perhaps it was natural in the circumstances that the strangers should carry arms, but the discovery was not exactly soothing.

To add to their embarrassment, they had both just noticed another curious thing: the green men did not have proper hands; they had, instead, three thin twig-like fingers springing direct from skinny wrists. No doubt the green men thought this per-

fectly natural and proper; no doubt the human hands they now saw seemed to them fantastic malformations, but the professor and Wintringham were Englishmen; they had deep instinctive feelings concerning what was good form, and the sight of such radical departures from English standards caused them acute embarrassment. Both then and subsequently they spent a lot of energy trying in the most well-bred way to avoid noticing those long green fingers.

But Butch, though he was English, was no gentleman yet; he had no complexes, no inhibitions, no embarrassments. When he saw the fingers he screamed with excitement, grabbed a stalk-like wrist and held it aloft.

"Look!" he cried. "Look! Just three fingers! Just three fingers . . ." His words became a chant. "Green men got three fingers! Green men got three fingers!" He held his own soft, hot, grubby paw beneath the three pale twigs. "Butch got

more," he announced, looking up with wide fearless eyes.

A jade-coloured hairless alien face bent towards him and grinned a toothless alien grin.

Eric Wintringham's house—it was, in fact, his aunt's—was a fine specimen of the smaller sort of English country mansion of the seventeenth century. Its gardens and lawns were well-kept, the oak floors were well polished, the furniture was old and dark and well chosen, the rooms wide and cool and sunny.

The strangers examined, inspected, touched, twittered to themselves and grinned to their hosts. The latter were confident their odd guests could not fail to get an impression of civilised ease and pleasant living.

Wintringham had sent his housekeeper away for the afternoon but, before leaving, she had set out an excellent cold meal. However, the two green men did no more than peck cautiously at the food and take a sip or two of the wine.

Just in case this picture of arcadian ease and plenty was too strongly emphasised, the visitors were offered glimpses of the technological aspects of Earth's civilisation. There was an immense refrigerator in the kitchen; a magnificent radiogram . . . Wintringham put on a Schubert piano impromptu; there was a television set—the strangers were shown the antenna on the roof just to make quite certain they understood. Finally, Wintringham, who was an enthusiastic cine photographer, showed them his most recent film—taken during a holiday spent in Annecy in the French Alps. It was in colour; the reds and blues and yellows positively glowed, the lake sparkled, well-dressed men and women walked with leisurely confident ease, the buildings gleamed white in the sun.

"That's enough," Wintringham exclaimed at last, snapping the switch of his projector, "in fact, we're overdoing it . . . Let's hope no one ever shows them Manchester on a foggy November day."

"Perhaps they know," David remarked. "Perhaps they've telepathed us." The two green men looked curiously at him as he said this.

But it was too much to expect that these impressions of leisured ease should not be marred in some way. A serpent lurked in this Garden of Eden—actually in the garden of Wintringham's house.

This particular serpent wore a Stetson hat, an ornamental waistcoat, leather chaps, a belt from which dangled two expensive and efficient water-pistols, and a scowl. He called himself—at this particular moment, at any rate—Two-gun Tex. He was described in the Parish Register, and was known to his parents and others as Herbert. He was the son of Dr. Eadie.

He happened to be in the Wintringham garden that afternoon because he meant to "get" Butch; but when he saw the two green men walking in the garden it occurred to him that it would be equally satisfactory to get them in-

stead. After all, they were small, they were strangers, and rather fragile-looking, and, by the funny way they walked, it did not seem that they could run very fast. Herbert never attacked anyone bigger, stronger or speedier than himself. Herbert waited behind a bush, a hand on the butt of each gun. The green men shuffled down the path looking at the flowers. Wintringham and the professor were some distance away, and Butch trotted behind.

The incident lasted only an instant. Two-gun Tex, Stetson pulled low over his eyes, stalked out from behind the bush, drawing his guns.

"I'll kill you," he growled, pointing the water-pistols at the strangers. They halted, startled. Tex stood scowling ferociously, enjoying their fright. Butch pushed his way between them.

"It's Herbert," he cried. He hurled himself against Herbert, butted him in the stomach, kicked him on both ankles and attempted to

wrench the water-pistols from him.

Herbert's mother claimed that her son was the kindest, gentlest, most noble-minded boy in the neighbourhood. Nevertheless, it was a matter of observation that the slightest opposition to his intentions reduced him instantly to a state of maddened rage. In this case, his fury was only equalled by his terror. He ran off screaming.

Ten minutes later, when he reached home, he was screaming louder than ever. Admittedly, after passing beyond hearing of his assailants and until he got within range of his own home, he had economised his spleen by remaining silent. He devoted the ten minutes' interval to constructing a story of an attack by seven green giants ...

Professor Cornwall was much distressed by this incident. During the instant of Herbert's attempted water-pistol attack he had seen a cloak-like jacket whisk open and the brief appearance of a

long slender metal rod, and he realised how easily some small misunderstanding could lead to disaster. He picked up the water-pistol, dropped by Herbert, and demonstrated its harmlessness to the visitors. He did not get the impression that they understood.

That evening Dr. Eadie drove up to find out the truth behind Herbert's gruesome yarn. No doubt he very nearly believed Wintringham's story, but it is quite certain his wife did not.

Next day quite a number of the village womenfolk learned that dear Herbert had been ill-treated by three foreigners.

And, of course, in various accidental ways, other people found out about the green men also. Jimmy Forsyth, the assistant bank manager, and May Flynn happened to pass along the top of the hollow about eleven. Admittedly, in both their accounts of the matter there was—and still is—a certain discreet vagueness as regards the time and pur-

pose of their passing, due, perhaps to the fact that Jimmy Forsyth was engaged to a girl in London and May Flynn was "going steady" with a local young man except occasionally when that particular young man was working overtime. At any rate, both parties reported having seen the spaceship lying there, with a long beam of reddish light pouring from its port, and numerous other smaller lights dotted about the hollow in its vicinity.

The village poacher—who, contrary to all tradition, happened also to be the schoolmaster—had some sort of encounter with the strangers which he did not describe with any precision.

Finally, and most ominous of all, there were the investigations of Joseph Yulebottom, the constable. He was a tall, thin young man with black wiry hair, black shoe-button eyes, a neatly trimmed moustache and thin tight lips. He never smiled.

Constable Yulebottom

wasted no time growing roses or dahlias or fielding in the cricket team as other village policemen do. He devoted all his mental and physical energies to his job. He wanted promotion.

Constable Yulebottom was imbued with the conviction that all men were rogues and liars everywhere and all the time, so he listened to their words, watching them with his little black eyes, always disbelieving, always wondering what crime they were concealing. Constable Yulebottom divided the world of rogues in which he lived into two categories, the unimportant and the important. He pursued the unimportant—that is to say, the young, the weak and the erring—on every occasion with the utmost rigour of the law. He never troubled influential persons about minor matters like infringements of the licensing laws or car parking regulations, since their enmity could be dangerous; such people should not be meddled with

until the day they committed some offence that was big, juicy and expensive. He believed in never kicking a man till he was down.

The constable called on Professor Cornwall to ask him about the strangers living in the hollow.

The professor gave him a very carefully considered account of the matter, explaining that the visitors appeared to be foreigners of some sort; very queer-looking but perfectly harmless. He advised Yulebottom to leave the visitors alone. Joseph listened to the professor carefully, watching his face. Then opening his thin lips sufficiently to say thank you and to assure the old man that he would not go near the hollow, he mounted his bicycle. He rode down the highroad and turned at once up the lane leading to the pond and the hollow.

He walked all round the space vessel. He had not the faintest notion what this object might be, and was neither concerned nor frightened by

his own ignorance. He merely thought to himself that here was something that might bring him in a bit of business. As he stood there he asked himself whether any offence was being committed or whether any crime was being planned. He began to think along the lines of Communist agents, saboteurs—and, of course, the professor was a scientist.

Within a week of their arrival the entire village knew about the green men.

Even from Bibbington Parva, men had gone abroad during the last war, to Burma and India and Malaya, so the green men could scarcely have passed as Chinese or Japanese, had they been seen. But they were not. So at first they were described merely as nasty foreigners, friends of the professor.

The green men made a second visit to Eric Wintringham's house. Eric had been ravenously devouring every science fiction book he could

lay hands on. He read night and day, interrupting his studies only to sleep a little and to eat enormously, and occasionally to consult David, Scottie and the Maltby boys, the local interplanetary experts, on obscure technical points. Now he wished to try out a number of ideas.

The two green men came willingly. This time they brought devices which, however odd and unworldly they might appear, were almost certainly picture-recording devices of some kind—cameras, in fact.

But Wintringham was eager to try out his ideas for establishing mental contact with the aliens. He led them into the drawing room, sat them down at a table and spread out sheets of paper. Professor Cornwall kept in the background. He still felt a little out of his depth despite the evidence of his eyes. Now and again he passed a hand over his brow and wondered whether this was all a dream. David, Scottie and the Maltby

boys hovered round ready to act in an advisory capacity.

Butch had appeared from nowhere as usual. He had no doubts or fears about the green men, and had accepted them with the same child-like casualness that he might have exhibited towards a giraffe or an elephant. He chattered to them, tugged at their clothes and thumped their flanks with a grubby fist when he wanted their closer attention.

Wintringham drew first of all a landscape sketch showing the sun rising above the house; he added a diagram of the solar system, showing the planets in their proper positions, and, finally, by gestures, drew attention to the third planet. The strangers got the idea immediately. One of the two whipped up the pencil, considered it for an instant, and then with lightning motions added the outline of their space vessel to the diagram, positioning it right out beyond the solar system, and from that point drew a line inwards. The line took a

twisting and curving path, touching first at Mercury and then at Venus before terminating on the dot that represented Earth.

"They come from outside the solar system, and they looked in at Mercury and Venus," Wintringham exclaimed delightedly. The boys didn't bother to reply; they thought this was pretty elementary stuff.

David now spread a star map on the table, and by gestures invited the aliens to indicate their home.

This was more difficult. They peered at the map, twittered to each other and made questioning signs to David which he was unable to understand. Finally, they rather doubtfully pointed to one of the fainter stars in the constellation of Orion. A swift pencil-drawn diagram added the information that this star had only two planets and that the visitors came from the outmost.

An attempt was made to learn how long the journey

had taken, but no common time-scale could be established. Later, Professor Cornwall tried to obtain information about the size of the visitors' planet, its population, its climate, and, above all, about the principle upon which the ship's motors operated. This, as might be expected, led only to confusion—at least, confusion in Professor Cornwall's mind, for David claimed to understand the diagrammatic explanation of the drive.

"My dear boy," his grandfather pointed out irritably, "you're only beginning to study electricity and magnetism at school; you've learned nothing yet about gravitational fields—you haven't the foundations of learning required for an understanding of such a subject."

"Still, I think I understand," the boy persisted stubbornly. "It's something quite simple, connected with the time-interval between successive pulsations of a gravitational field . . ." He hesitated, and looked towards one of the

green men who appeared to be listening to him alertly.

"Rubbish!" the professor exclaimed. "A gravitational field doesn't pulsate."

David said nothing. He just folded the diagram and put it in his pocket.

Wintringham, whose fertile mind was bubbling over with ideas, had planned and timed this second visit with considerable care. A little later he switched on the television apparatus. This he did quite casually, merely as if inspired by a passing thought, but in reality he had planned this visit and carefully timed the switch-on to bring in one certain programme. The programme consisted of reconstructed and re-arranged sections of one or two recent films and was entitled "Journey into Space."

The agile-minded Wintringham saw no reason to doubt that the green men would take this film item to be a genuine report on a bona-fide space trip.

But the relations of the green men with Bibbington Parva could not remain static for ever . . . Two days after the visit one of the three walked up the High Street. It was market day and he was seen by sixty or seventy people, many of whom were entirely sober. A couple of days after that Two-gun Tex, who ever since his first encounter had been out to "get" the green men, at last caught up with two and drenched them thoroughly. In return they quietly dunked him in the stream and sent him home screaming.

The editor of the Helmsford *Courant and Advertiser* telephoned Eric Wintringham. There were rumours of strange visitors, spaceships, strange lights shining at night across the heath, alarms at night. What were the facts of the matter? Wintringham's attempt to laugh it off merely strengthened his suspicions.

One night the aliens killed farmer Hornby's prize bull. At least, it was found dead

next morning with a deep, pitted, scorched hole in its shoulder.

Constable Yulebottom no longer spent his time lurking at the bottom of the High Street ready to pinch motorists who disregarded the halt sign. He circulated constantly on his bicycle in the neighbourhood of the marl pond. He believed that Professor Cornwall—a scientist—and Mr. Wintringham—who was a writer—were in communication with foreign agents. He intended to make an arrest as soon as he had evidence.

"This business can't be kept secret much longer," Wintringham told the professor. "Something must be done to regularise their position, otherwise they'll be lynched. They'll be jailed as undesirable aliens."

The boys were of the same opinion, and, of course, they knew exactly what would happen—the thing that always happened—the army would be brought in to keep sight-seers away from the spaceship

and prevent the aliens doing mischief. There would be guns and tanks. Sooner or later an excitable and nervous 2nd lieutenant—it was always an excitable and nervous 2nd lieutenant—would take fright and open fire. The aliens would sizzle up the gun, the tanks, the lieutenant, the army and the surrounding countryside with purple death-rays.

"I don't see our green men sizzling people up," Scottie protested.

"Didn't sizzle up Herbert," Butch pointed out. "Just threw Herbert in the water." He gave a shriek of joy at the recollection.

"The point is," David reflected, "we've gone to a bit of trouble to show them we're a decent lot of chaps. If folks begin to gather with pitchforks and shot guns and if they get hustled by the soldiers, or even if people come with cameras, they'll begin taking a dim view of us. I think we must tell 'em to leave."

And they went right there and then and did just that. Standing outside on the grass by the door of the spaceship the boys explained and gestured and pantomimed, and the three green men watched and twittered among themselves.

Of course, it was never certain how much the green men understood, but it is a fact that next morning they were gone. In the hollow there remained nothing but a large patch of gorse and bracken that appeared to have been crushed by some weighty object.

Mr. Wintringham, the professor and Mr. Maltby quickly realised that now the ship had disappeared talking would only bring down on their heads whole gales of derision. They kept silent. Not everyone in the village did so, however. Mrs. Eadie gave a graphic description of her darling son being tossed into a stream by five seven-foot monsters, all green. The reporter listened solemnly,

tongue in cheek, and took down every word she said. After reading the *Advertiser's* report of this interview with Mrs. Eadie, the rest of Bibbington Parva determined firmly to remain quite, quite silent.

The boys never told anyone about the green men either, which was rather curious if you come to think about it.

Thus very little real hard evidence of the visit ever came within the reach of enquiring outsiders.

But two items of evidence remained. One was the sheet of drawing paper on which the green man had sketched the diagrams illustrating his ship's drive. David was very secretive about that piece of paper. He never mentioned it, but often, when he was alone, he took it out and brooded over it. The other piece of evidence was a hundred foot strip of sixteen millimetre film which Scottie had taken of the green men and their ship.

To buy the film he had

turned in the return half of his railway ticket from Bibbington to Scotland, and had, unknown to its owner, of course, borrowed Wintringham's camera. Since Scottie knew nothing about filming technique, except what he read on the carton about exposure, the film was almost perfect. But no one except the boys ever saw the film.

The three green men sat in their ship and watched the sun slide backwards and its planets diminish in diameter until they vanished.

They looked at one another and laughed.

"We're fortunate to be well away from those," one remarked.

"What people they are!" the other exclaimed. "They've never been off the surface of their footling little planet, yet even their children instantly recognised us as alien, identified the ship, calmly received us and entertained us."

"And devised techniques

for communicating with us. And proceeded at once to pick our brains."

"What goes on inside the things they call their minds?" the third asked.

"I'm not sure," the first speaker replied. "I wasn't even beginning to get the pattern of their thoughts until the very last. However, it's clear the young members of their community recognised us for what we are. I don't think the elders ever really succeeded in doing so. The youths made a plan and induced their elders to put it into operation. The plan was devised to make us realise the amount of their intelligence, and the state of their science and technology. They were trying to impress us. To make us fear and respect them in fact."

"Why?"

"So that we shouldn't think it possible to attack and invade them."

The listeners looked at the speaker in puzzlement.

"Why should we wish to

attack them—or invade them?"

"It isn't clear to me. They assume that their planet must be more attractive than any other. They assume also that every race on every planet must sooner or later over-crowd itself and try to spread. They appear to assume that it is a rather natural thing for anyone who is defenceless to be attacked."

"Alien thought-processes are invariably incomprehensible," one of the green men commented. "Why did they urge us in the end to leave?"

"So far as I could understand, the youths feared we might be attacked by the

older members of the community. My impression is that between the older and the younger generation there has been a very pronounced evolutionary change giving rise to a sharp upward jump in intelligence levels."

"It's possible—— How shall we report on the race? Something like this, I should suggest—Society technologically complex rather than truly civilised; intelligence about fifty; eager, flexibly minded, aggressive in outlook, almost belligerent; intellectually unstable——"

"Likely to constitute quite a problem, if we should ever meet them out here in open space."

Positronium—Continued from page 14 always splits into three photons. The difference between their energies, whilst only about a thousandth of an electron volt, shows up quite clearly in the frequency of the radiation that they emit.

The research scientists calculated this to be 203,370 megacycles a second. Actual experiment found the figure to be 203,350—with an error of plus or minus 50—megacycles a second. A great triumph for the science of quantum electrodynamics on which the calculations were based!

The new system is uncomplicated by the presence of protons and neutrons

which are, as yet, imperfectly understood. Science is forging ahead along these new paths of knowledge which may lead anywhere. Who knows what further secrets will be uncovered? The inner mysteries of conversion of mass into pure energy may lead our enquiring minds on to techniques and sciences as yet dreamed of only between the pages of science fiction magazines.

The extreme shortness of life of positronium, however, presents a serious drawback to our professor who might wish to use his substance which is "lighter-than-hydrogen!" The future alone, we are confident, holds the answers to such problems as these.

The world thought him a
hero, but he was just a—

Firecracker Fool

by PETER GREEN

ROGER FULTON CAME DOWN the treads on the firecracker's fin, through skin-prickling heat where his jets had seared the pit, feeling like some condemned soul creeping back on a fragile thread from the pits of hell.

He put one foot on solid earth. Then the other. He stood there, not really believing he was back, letting the cool dark strength of the soil flow up his thighs and back. He sucked a long, slow luxurious breath of evening air into his lungs, tasting the faint flat smoke of afterburning, the sickly grease-smell of oil, the penetrating crispness of newly cut grass, letting them flow and blend and sinking his body into their embrace.

He needed a cigarette. "Got a cigarette, Mac?" The rocket-handler began to protest,

looked at Fulton's face, and changed his mind. He shook out a cigarette.

Take the cigarette like a pot of incense. A filthy drug, a narcotic to deaden the pain that thrilled along his nerves. He fumbled the lighter, the metal warm under his fingers. His harsh breath blew the still flame out twice. Drag on the cigarette, the smoke cool and satisfying and altogether hateful.

The field was quiet now after the impossible noise of his landing. A scattering of birds flew away into the far trees. It was all very calm. He felt as though he had pulled his body from the Inquisition's stake.

Walk through to Reception, remember to save a big smile for the girl at the desk.

"Captain Fulton, nice to see you. Good trip?"

Good trip? My God! The merciless pressure, seizing his body and binding it into the couch. The anxiety lest a drop of sweat should seep past his forehead sweat-pad and blind him at a critical moment. And all moments were critical. The responsibility. The crushing knowledge that he was alone, in sole command, Lord of all he surveyed.

That was a laugh. Servant; slave; abject, grovelling and completely servile to the machine, that was what he was. King of Space, with a sweat-dripping face and agonised body.

"Sure, gorgeous." Say it with a laugh. "Sure, good trip."

"You space jockeys see life! I shoulda been born a man."

Crack wise, make her smile, think what a great guy he was. "What a waste that would've been," he said, winking, walking on over the cool tiles towards the office.

The girl lowered her eye-

lashes and twittered and he wanted to vomit. He found the cloakroom. He clung to the porcelain basin and shook. Shudders reached down his body and took the flesh and rippled it and churned his stomach into a whirlpool. He wiped his mouth.

Get a hold on yourself! This is Earth. Space is far away, behind a comforting blanket of air. He straightened up, feeling feebly for the towel, his mind made up.

This was his last trip. He wasn't chancing a single solitary thing from now on. Oh, sure, he always said that, after every run of the ferry rocket—only this time he meant it.

Let them get someone else, some other drivelling fool with stardust in his eyes to take the firecracker up to the space station and back. There were plenty of them. Fresh-faced youngsters with an electric razor in their kit ready for the next year, or the year after. Full of the dream of taking a metal shell out past the barriers chaining them to this

ball of mud. Ball of mud. He laughed. Dear, beautiful, wonderful mud. He'd wallow in it for the rest of his life.

He straightened his uniform. Wiped away the smears. Out of the cloakroom with head held high. Return those salutes, snap the hand, fingers together and stiff. Act the big-time space pilot, the firecracker jockey, the man who rode the jets down to Earth. Of course! He'd been forgetting. He was some kind of hero.

Inside Commander Samson's office he was cut down to size. Samson, with a brush of white hair barely concealing the scar he got when *Nova* buried itself in the Australian desert. Samson with one eye missing. Samson who knew all about the insides of his pilots.

"Sit down, Roger. Cigarette?"

"Thanks." Where had that other cigarette gone to? Never mind. Set fire to the whole damn spaceport. Might be an idea, at that. No more scream-

ing awake at nights dreaming he was coming in on jets that refused to work. He shifted in his chair uneasily. He felt the muscles in his left cheek contract and go numb. He fought it. Darkness grew around his vision, growing in as his left eye closed. He felt a ragged beat of blood in his face and, by some well of strength that came from somewhere he hadn't the energy to discover, he managed to open the eye. Sit tight. Make as though it hadn't happened. Smile, boy. *Smile!*

"You're due for your medical earlier, this time, Roger." Samson was looking at him now with that stare that said: "Fulton, you're cracking up."

"Okay, commander. I'm easy. I could ride one of those babies down in a wheelchair."

That was the way. Talk big, make with the confident, brash, easy-going sort of efficiency that was raved over by Sunday supplement writers. He had a horrible half second when he thought he was going to black out and fall off the chair.

The thought sobered him. What was Samson saying?

"You'll have two days' leave, Roger. Then Station Four on a routine run."

"Four, eh, commander? That's a stiffish run—right round the globe on an inclination angle."

"I know, Roger. That's why I've picked you for the job. Four have to have their supplies and the regular run from their own base has been held up. So we get detailed for the job."

Samson's stare made him acutely conscious of how he must be looking. He dragged on the cigarette and the muscles round his mouth stiffened and almost—almost, refused to obey.

Take the cigarette out of your mouth with calculated ease, lean back in the chair, one leg over the other—he had completed the movement before he had time to contemplate what he would have done had his legs refused to obey the dictates of his mind.

Smile. Look coldly competent and unperturbed.

"Your wife rang through, Roger. Wanted me to authorise the pay office to advance—"

"That's okay, commander," he cut in, quickly, embarrassed, annoyed at this open flaunting of his private life. "Did you?"

"Oh, sure. I knew you'd bring that fireball in safely, and, anyway, you are due some back pay."

"Thanks." Should he break the news now? Tell Samson that he was quitting, that he wouldn't be taking that firecracker up to Station Four? Not yet. Savour the knowledge in his mind that he had finished with all that. Sit and luxuriate in the thought. Come to that, he could ring Samson from home—from his wife's home, that is.

It would be easier that way.

Samson was shuffling papers on his desk, his hand going to his recorder. "Righto, Roger. We'll be seeing you in two days, then. Have a good leave. Oh—and my compliments to your wife."

"Thanks, commander. Lita will appreciate that."

Stand up, walk out of the office, keep that smile, boy. Keep that cocky, rakehell sureness. Let 'em all see what a rip-roaring, rough and tough hombre a firecracker jockey was. They'd all say they'd give their ears to get out into space. To ride a package of living death up and out. His left cheek was twitching again and that damned crepe band was narrowing his vision like a blasted undertaker's top hat.

Snap hard heels along the tiles. Back straight. Out into the evening, the beautiful golden Earthly evening.

"Taxi!" The gyrocab's vanes like a saint's halo, shining and powerful, drawing him up from the Earth—a panic moment when he wished he'd taken a ground car. The Earth looked very far away.

How near the Earth looked from the station! Like a tossed up football, wreathed in frosty breath from panting players. How near the deep curve of the globe as the

station fled across the latitude lines, spanning an emperor's conquests in a heart beat.

The gyrocab tilted, preparing to swing away towards the clump of concrete reeds thrumming with the life of ten million human ants. Below and away on the spacefield's pitted expanse a firecracker stood like an admonitory finger threatening the demons of space. Last rays of sunshine caressed the needle hull, glinted from the wide-planted fins, setting purple shadows above the cluster of tubes. That would be Joe Pzinacki, big, lumbering, raw-boned Joe, all of five feet tall. Taking up the shuttle into those regions he had just left. Going off on his fool's errand of mock heroism. The rocket was like an exclamation mark pointing up the stupidity of it all, the folly of expecting men to retain their humanity in the inhumanity of space.

Flames wreathed from the tubes, like a last tribute of blood red roses on some shrine to the fallen dead. Inside he

could see quite clearly without closing his eyes what was happening. He could visualise himself in Joe's place. Strapped to the couch, nerves taut and shrilling already with the desire to get on with it, accept the pressure, the pain, the choking loss of self-respect. Get up. Get out. Lance away from the contemptuous ball of mud on beautiful wings of flame—bah! Whatever Joe might be feeling now, he knew that he could not any longer share those glorious, high, utterly futile dreamings.

The rocket rose leisurely. Calmly and serenely. There was majesty in this defiance of natural laws; something there he vaguely remembered having once believed in. Strangely, he had the idea that once he had ridden the firecrackers with eager expectation, with no fear, no self-reproaches of agonised waiting for the inevitable end.

Joe took the ship up cleanly. She was a fleck of fire against the evening dusk. The fleck blossomed.

Grew. Expanded into a filthy mushroom of flame and smoke and heat. Wind and sound tore at the gyrocab.

"My Gawd!" The taxi driver twisted a pallid face to Fulton. Green and shaking. Like a world's self-conscious condemnation of itself.

He could say nothing. Joe was in there. Joe was a few shreds of cloth and bones and blood. Vapourised. The firecracker had turned over, fallen, had blown itself apart like a deep-sea fish erupting onto the surface.

The metal of the gyrocab's side was a pain under his fingers. His face was frozen. He couldn't move a muscle. He tried to open his mouth, to speak, to break this spell.

Horribly, words came. "That's a chance we all take, brother. His turn today, mine tomorrow. Get this heap moving! I want the bright lights!"

"Sure, captain. Sure."

The taxi driver would tell his pals how tough and rough these firecracker boys were. He'd tell

them! The irony of it all made him want to shout a crazy song—then he remembered.

Of course. He was out of it all. He'd ring Samson as soon as he reached Lita's apartment. Funny. That would be his apartment from now on. He'd have to find a job, something, anything. Lita liked the things his money bought.

Pay off the taxi. Ride the strip up to the block. Find the bell. Ring.

"Roger! Darling!" A wash of sound, music, laughter, bottles popping. People clumsily dancing, crashing into chairs and tables. Heat and the suffocating reek of stale smoke and alcohol fumes.

"Lita. Good to see you." Smile, boy. Put on the old act.

"Well, come on in, Roger. We're having a party. In honour of Basil. He designed the most utter costume for the ballet—but you must see it." Lita. Lita of the flame hair and rich lips and the lissom body, like a volcano sheathed in ice. Lita. His Lita. *His*.

"Howdy, Roger, old boy!"

"How's the Guy Fawkes business, eh?"

"Still here, then. Lucky fellow!"

"Oh, don't take any notice of them, darling." Lita smiling, welcoming him. Basil coming forward, scowling, lifting the scowl and smiling as though it hurt him.

"Why, hullo, Roger. Nice to have you back. Staying long?"

As if he didn't know. Basil must think him a blind fool—but he was, wasn't he? Blind to the things of life that meant more to this crowd than any thought of the empty reaches between the stars. *Smile*. Sure, he wouldn't be going back there any more. Not any more. And Basil would have to find someone else's wife to design ballet costumes for.

"Can't say, off hand, Basil." Basil's hand, like a clammy fish dredged from a scummy shore. "Been enjoying yourself?"

"Certainly have." The sidelong glance at Lita. The veiled look of insolent possession. Take it, boy. It wouldn't

be for very much longer. He and Lita could go away—but that was an idle dream, a phantasm of the might have been.

Lita bent down, kissed him; he could hear the creak of her plastic foundation garments. They were right against his face. She straightened, laughing in an embarrassed way that tore lumps from his heart and tossed them to the ravening wolf stares of these morons giggling round the room. Liquor stank everywhere.

"Have a drink, Roger? But, of course, you don't, do you?"

For one wild second he fought the desire to snatch a glass and toss the contents down. That would finish him for sure. He wasn't used to the stuff. How these friends of his wife would laugh.

Lita was a gleaming sliver of light, whirling among her guests. Fulton stood, forgotten, forlorn, wondering if she would deign to speak to him again this evening. Basil's arm

was round her waist. His fists clenched. Relax. Basil was a hefty six-footer, rugger man, blue. It would be a massacre.

Lita snuggled her head alongside Basil's. They fitted together, male and female, perfectly matched. They made an imposing couple. He fumbled a cigarette from the silver box, began to look for a light. His hands were steady now.

She'd have to go away. There was no other course left for them. The room crowded in on him like a torture room, growing smaller by the second. With brilliant lights and the reek of alcohol in place of sword blades. They were no less effective.

He found the balcony. Cool air against his fevered face. Clean wind to wash away the miasma behind him. A shout.

"Shut that confounded window! We'll freeze to death!"

Obligingly, he closed the french windows. What did they know of freezing, or of death, for that matter? Up there, the stars frosted down in twinkling

unconcern. Once, long ago, he had stood like this, yearning to ride up there, prance among those chips of fire, seek the high adventure that beckoned from space. So long ago.

And here he was, a hardened veteran of the ferry-rocket service, so hardened that he vomited every time he clambered aboard. So tough that the thought of riding the firecracker again brought him up screaming on a sodden pillow. So rough that the imagined feel of the acceleration couch against his body made him want to tear off his clothes, fling them over the balcony rail.

What would Lita say if he quitted the space service? What would she do when she couldn't lift the telephone and draw safe money from his pay? He was still standing on the balcony, quite cold and not feeling it, when the last guests left and a sulky and frustrated Basil had been shooed away. Lita called to him.

He came quickly. He went

through to their bedroom, hating himself for his own weakness and knowing that he could not hope to fight it.

Lita was a poison in his veins. A drug, soporific and demanding. Why she had married him he could never understand. Oh, sure, the money. Hell, she could get better money than that doing what she loved to do. Her own career had been given up very easily—perhaps she just disliked work. He didn't know, and he didn't care.

Came the morning and the afternoon and the evening when another party started again. He didn't bother to enquire what this party was for. He knew it wasn't for him, that was sure. He still hadn't told her that he was giving up the space service. He shied away from the idea. He felt vaguely that if he gave up space he would also lose Lita—it was a formless feeling at first; but it grew, even with the creature Basil creeping in with no bottle like the other guests and immediately monopolising Lita.

Keep that smile on your

face, boy. Let Lita know what a good sport you were. Don't forget, a member of the space service, a firecracker jockey, a tough and rough guy. Smile, boy. *Smile.*

He was happy and reluctant to leave the next morning. Lita lay in the wide bed, flushed and heavy-eyed. She watched him dress, carelessly, munching a chocolate.

"When are you coming back, Roger?"

"No idea. I may not have to—that is—I may decide—"

He hadn't rung Samson yet.

"What is the matter, Roger? You ill, or something?"

"I'm all right." Short and sharp. Don't worry about Lita's reactions. Tell her right out—I'm finished with space. Getting a ground job. Tell your friend Basil to get out and stay out. That was the way. Incisive. Like a correction when you came in too far over on course.

He said: "I think I'll run over to the spacefield early. Don't want to miss checking the ship."

"All right, Roger. For a minute I wondered . . . But no matter. I was just being silly."

He went out, still a little dazed. His face obeyed his orders. He was feeling better. No more of that grey skin and the feel of it, pebbly and corrugated as though he had put his head inside a potato peeler.

Just a little stupefied. Why hadn't he told Lita? Why hadn't he rung Samson? He didn't know. Must tell Samson as soon as he reached the spaceport, save the formality of the medical.

One thing was for sure. He couldn't face crawling into the shining metal guts of a ship again. That was out.

He was a coward? Hell, no! Just that—well—he'd had a long run, he was tired—his body was in perfect shape after two nights' rest. His muscles obeyed the dictates of his mind. He felt fit and on top of the world. No, he wasn't tired. He couldn't blame fatigue for the way he felt. Then, what?

Face it, boy, face it—and still smile.

He was scared.

He was scared stiff of the silver beauty of the firecrackers.

Commander Samson stood up when he came in. Samson's keen eye pierced through the shell of the firecracker jockey. Samson had been a jockey himself. The furniture in his room was designed for firecracker jockeys with no allowance for the lumbering size of the rest of humanity. The commander said: "Medical okay, Roger? That's good. Station Four need that stuff you've got aboard." He held o'this hand, hard and strong, reminding Fulton of Basil's flat-fish revolting dab. "Good luck, Roger. And bring her in on the nose."

He licked his lips. Now was the time.

"I'm not—" he stopped and swallowed. "I'm resign—" he stumbled again. Samson smiled. Fulton said: "Lita send her regards, commander. Thanks for fixing that cash."

"Forget it." Psychologist Samson; no surprise at the twist of the conversation. Fulton tried again. He must tell the commander now; but did he really want to? Hell, he wasn't going aboard another firecracker, not for the world, he wasn't. Which was a joke—when you were up there you had the world, right under your thumb.

He said: "See you soon, commander. Wish you could come with me."

He walked up the treads on the fin, sat in the cockpit, waited for the blast of power that would lift him off the Earth—and he still couldn't reason out why.

He was tricked on the Moon,
and went on being—

The Dishwasher

by G. C. DUNCAN

GIOVANNI LIKED TO watch the glare of the rockets reflected in the purple evening sea. He would stop and screw up his eyes waiting for the thing when he heard a thunderous roar overhead. He would open the window another fraction, pausing with a cup in his hand, his whole old body tense, then there would be the patch of fire-cooled reflection on the sea, moving steadily across the water. Giovanni would breathe a deep sigh and wash the cup with increased energy.

"You're too old," Pietro would say. "You'll never live in the acceleration. They say your body is squashed flat, your nose bleeds, your ear drums collapse. After the first ten minutes you would be senseless pulp. Anyway, why should a dishwasher want to go to the moon?"

Giovanni always smiled at sneers. "My little Pietro, would you not like to see the

moon before you die? Do you always want to wash dishes in Mr. Luigi's restaurant? Can you not lift your little mind higher than the legs of your Maria? Eh? Tell me."

"You leave Maria alone. She loves me and you're too old to understand." Pietro spent most of his time dreaming of his Maria's charms and the mention of her name was an intrusion of his privacy.

Giovanni smiled through his moustache and pulled the window shut.

He wanted to look for the last vanishing streak of the glow of the moon rocket in the sky but, instead, turned back to his labours. It was strange that it had to take twenty years to save for one glorious adventure. There was the time when he had been a Pietro and thought of nothing else but the charms of his Camilla.

She had been a glorious creature. Her hair had been black and long, coal-black and glistening eyes, and lips

with the strange red glow of the machine which had just passed overhead. But what endeavour it cost a man. It was different for women when they were young. They did not look at man as a human being. He was an integral part of the community who had potentialities in certain respects, a dangerous creature capable of enslaving them if they allowed privileges which could become lashes for their backs and chains for their hands.

All men were the same. That had been Camilla's philosophy, the philosophy which had driven him beyond love. It was all very sad until he made the moon his mistress. She had a magical quality of purity and mystery, Giovanni decided. She lay for ever on the seductive pillow of purple space. She was a lover worthy of his efforts, she beckoned with a seduction which his earth-bound loves had never achieved. That was why he had worked for her. She shone for him alone, and though other men may look upon her with parted breathless lips, she was for him alone. Beautiful, almost unattainable, a restful beacon for the disappointed passions of his youth.

It was strange how his mind had fastened upon that colossal rock. He would bed with her before he was much older. Bedding with the mind was better than the body. The body. It was a poor thing, the chemists had told him. It did not obey the rules; something about some hormones missing. How could one have hormones missing?

Maybe he hadn't understood their long words nor the film they had shown him. It was like having a leg and not having one because it didn't do all the things that legs should. They said that was why he would always be slaving at rough work. They were wrong to think that he should wait for machines to work for him. She could see every little thing he had ever done. She looked at him from her cloudless sky knowing that he used his body to work for her, nothing less. It was his sacrifice to her and she would know that he could have done less and let a machine do his work for her. But what true lover would put a robot with his mistress?

"Giovanni. Giovanni, wake up. I have been talking to you for ten minutes and you take no notice. You were dreaming

about your moon." Pietro was half laughing at him.

He turned and grumbled in his moustache. "What were you saying that could suddenly become important, Pietro?"

"Why have you always worked and lived in the old cities? If you have always been so impatient to go to the moon you would have been able to make money quickly, anywhere but here. You are a fool, Giovanni. No one but a fool would have done as you have done."

"A fool?" Giovanni repeated half to himself, then: "Will you always be faithful to your mistress?" It was almost an accusation.

"Of course, Giovanni." Pietro was quick with his reply. "I love her." It was so simple.

"And your Maria? Is she not going to be a technician? Even now she lives in the modern city. She does not understand the ways of us who belong to the older ways. We hold fast to certain ideals—we believe in rules. We have no tolerance and that is their only regulation. They, the Tolerants, are a necessity to the community, otherwise the world would be back in its old

wars. If you betray her, she will laugh you off with tolerance, but if it is the other way about . . ."

He stopped at the expression which had stolen over Pietro's face. Then he continued in a mild tone: "That is why I go to the Moon. I have told Mr. Luigi that I am going."

"Did you tell him that you had paid the 10,000 credits for the fare?" Pietro was concerned.

"Why, yes. It is something that I have done. I have saved another 2,000 for my expenses on the moon. He was very interested in my idea of retiring when I come back." Giovanni was laughing at the memory. "Do you know, Pietro, he wanted to know if I was going to work for his brother, Alberto, when I said I was going to the moon. Just imagine it. I work for twenty years to save money to go to the moon to wash more dishes! It is a very funny idea." Giovanni broke into one of his rare bursts of laughter. Tears ran down his face. It was such a funny idea.

Pietro laughed a little and a little too harshly. "I don't trust Mr. Luigi. You must be very careful on the Moon. I

have been told that Alberto is really an old-fashioned citizen and has no tolerance. He should not be living with the Moderns. It is not right. He should be with his own people."

Pietro's concern for old Giovanni softened the lines in the older man's face. He put his arm round the boy. "Don't be silly, boy. Alberto is a Modern. Mr. Luigi is very proud of his brother. He is always saying how tolerant he is. There's nothing to worry about, nothing at all." He spun him round and put both his hands on his shoulders. "I will be going in a few days, Pietro, but before I go I want you to promise me something. It is about you and your Maria. She is a lovely girl, but she has been brought up to be tolerant and to expect tolerance. If she does not act as we of the Old-fashioned cities, then you must not be disappointed—nor bitter."

Pietro only smiled.

A few days may take a hundred years and that was the way it seemed to Giovanni. At last he left his dishes and boarded the rocket. The acceleration was not a torture. He did not die. The machine slid smoothly into the atmos-

sphere and with almost imperceptible acceleration gained height and sought its way out of the air which clung to mother Earth. Giovanni sat entranced. An obvious Old-fashioned citizen, his knees close together, his hat securely fixed on his greying hair, his arms crossed upon the small bag he had brought to contain his necessities. For a day he sat still and only occasionally moved to brush his moustache with the back of his hand. When he happened to see the surface of the moon through a nearby port he shut his eyes, and his lips moved beneath the moustache as though he was mouthing a prayer. His fellow passengers were all Moderns, and it was their way to ignore him even though each was aware of him. But their rule of tolerance was such that they could not interfere with him or encourage him to relax.

At the moon port the rocket settled neatly into a niche and the stern doorway exit plugged itself into the waiting socket, so that the tourists could disembark. The light gravity and the beauty of the bubble city was almost a hallucination. Each felt their way forward with timid feet. The tiniest

movement became an exaggerated swoop. They felt a little sick, but drugs eased their discomfort. They passed through a chamber especially padded for newcomers to become adapted. At last they reached the main city. All except Giovanni, who tumbled worse than the others and could not remember to ease his movements out of the habits of a lifetime of earth conditions.

Clumsily he gained the hotel. He caused amusement wherever he went by his seemingly violent leaps into the space above the heads of the walkers in the streets. Dishevelled, he arrived in his bedroom. He put his bag down in the magnetic gripper provided and endeavoured to clamber onto the rest couch. Three days later he emerged, weary, haggard, but more or less adapted.

It was the moon restaurant to which he first made his way. It was the show place. The first restaurant in space, owned and managed by Alberto. The soft, purple ceiling of stars was the sight about which he had dreamed. The thought of food faded from his mind. Fiery nebulae—burning coals flung wildly into nothingness

to stay in their allotted places as though time had paralysed their precise positions. Earth was a green cup with a pool of light throwing a shadow across one side. Giovanni looked and looked and could do nothing else. The restaurant, the people, and twenty years of washing dirty dishes faded from his mind. He could only look, savouring sight as a new experience. He had never known he had lived all his life, blind. There was a terror, too. Beyond Earth there was the great nothingness. It would fall, Giovanni thought. It would suddenly slide away, retreat ever faster away, so that it would crash onto something. There must be something for it to crash upon. It was a cup; it would crash onto a purple marble floor and all the bright shining pieces would slither out, seeking escape from the place where it had burst. Then each fragment would catch fire and burn for ever, hanging in the void. Giovanni blanched—this was Creation. It was too big for him. His mind reeled back into unconsciousness, unable to grasp that which was there to be seen. It saved him from madness. When he awoke

someone had equipped him with a blinker which shielded his eyes from the awful sight outside the dome. He felt sick again.

He drank a little stimulant and began to take an interest in those around him. It was the effect of the drink. He crossed his legs and sat comically at ease and even managed a small laugh of good humour. The Tolerants were the only people who could have built this bubble city. The Old-fashioneds would never have been ready for the things that could happen out here.

It was like a dream, misty and blurred. The restaurant was almost empty. Two old people were nearby. There was an altercation with the waiter. He could see the old lady was crying and the old man feebly waving his hands. The waiter was expressive. He also waved his hands and eventually departed agitated, to return with a stout man. Mr. Alberto, Giovanni decided, and again the pantomime of waving arms showing that there was something at difference. He moved nearer. They could not pay for the meals they had taken while they were staying on the

moon. Giovanni thought wildly—would they be thrown from the restaurant, from the moon? He could see them fading out into the awful void. Their arms would be outstretched, clutching at the vacuum. Their legs twisting as their bodies turned over.

"No—no," shouted Mr. Giovanni. "I will pay for them. Do not worry them any more. They can go back to Earth without fear."

He was not sure exactly what happened afterwards, but he remembered pulling his two thousand credits from the hiding place between his shirt and his skin. The notes were sticky with sweat, and his hands trembled so that he could hardly hold them while he counted. There were thanks and blessings and many shaking hands, and pats on the back, but Mr. Giovanni did not know what was happening.

He told Pietro about it when he got back. He added, in a puzzled fashion: "You were right that Alberto is not an Old-fashioned or he would have been tolerant and kind to those poor old people."

"It was a trap. Don't you see, Giovanni?" Pietro almost screamed at him. "I told you to be careful. They put some-

thing in your drink." He stopped on the edge of tears and breathing hard in his emotion. "He's a Tolerant, alright. Tolerant while it suits his purpose. They're a filthy crowd. Dishonest, scheming, immoral. The women . . ."

"The women?" Giovanni broke in. "What about the women? Your Maria. Has something happened? Tell me."

"Nothing happened. We just don't see each other any more." Pietro spat the words back at him. "It's you. You have no money. You cannot retire as you had planned. Did you tell Mr. Luigi?"

"It's all right, my boy. Mr. Luigi wrote to me asking me if I would like to come back, he had kept my job for me. He is a good man, Mr. Luigi." Giovanni bent his head over the dish water and Pietro busied himself putting cups and plates on the racks. There was a silence.

At last Pietro spoke. "Do you know, Mr. Giovanni. It's funny, isn't it? I saw Mr. Luigi had a note from his

brother and with it there was a thousand credits. I read the note. It was all a trap to get your money."

Giovanni did not stop working. "I guessed it. I had three days' freedom on the moon, then I washed dishes for a month for Mr. Alberto. But I should not feel bitter. Mr. Alberto has to live and if he cannot live any other way then it is well that there are Giovannis in the world for them to trap."

Pietro dropped a cup which slithered into fragments.

"Mr. Giovanni, do you know what you said? You're not one of us, you're *not* an Old-fashioned. You're a Tolerant."

"You may be right, but it has taken me years to find it out." There was a pleasantness and a humour on Giovanni's face.

He opened the window from habit and listened to the roar high in the sky, and together they watched the red reflection of the rocket sliding across the purple waters of the calm sea.



NON-FICTION

MYSTERIES OF SPACE AND TIME is an excellent and intriguing book by Dr. H. Percy Wilkins, Director of the British Astronomical Association Lunar Section. In clear, unequivocal language, Dr. Wilkins ranges over many mysterious aspects of the universe, including a very lucid exposition of the consequences of the relativity theories. This is real meat for the science fiction fan, and it may also be recommended to budding writers who are running out of ideas. From Frederick Muller (110 Fleet Street, E.C.4) at only 15s.

THE ORIGIN OF THE EARTH is of much the same

type, though written in more academic style and digging rather deeper into the evidence. The author, W. M. Smart, Professor of Astronomy in the University of Glasgow, is to be commended for his clear separation of fact, theory and speculation—something so often missing from popular astronomy books. The book is divided into three parts, dealing with: (i) the Earth's parentage; (ii) the Earth's date of birth; (iii) the mechanism of Earth's formation. Naturally, the discussion is by no means restricted to Earth. The entire solar system is considered. Highly recommended. From Penguin Books (Harmondsworth, Middlesex) at 2s. 6d.

PSYCHOLOGY OF ANIMALS IN ZOOS AND CIRCUSES is one of the most fascinating books a biologist or naturalist is likely to come across, and the fact that it is written by a trained scientist makes it doubly valuable. Dr. H. Hediger, the author, is Professor of Animal Psychology and Biology in the University of Zurich. His whole life has been spent investigating problems of animal behaviour. Hardly anyone else could have brought such experience and erudition to the task of setting down the ways in which animals think in captivity. Pleasantly free from homocentricity, this book examines in detail all aspects of captive animals' mental life. A few more illustrations would have been an advantage. Highly recommended. From Butterworths Scientific Publications (88 Kingsway, W.C.2) at 30s.

PSYCHOLOGY AND ITS BEARING ON EDUCATION is a book the importance of which can scarcely be over-emphasised. All who think seriously about the matter are agreed that most of the social problems of this age are due to the inadequacy of the

educational system—which has hardly changed in fifty years. Scholastically, our system may be excellent. But from the point of view of equipping the child to live in a disquieting, competitive world, it sadly lacks in both policy and leadership. C. W. Valentine, Professor of Education in the University of Birmingham, has here produced a book which, we hope, will be read and digested by teachers and parents everywhere. In it are laid down the principles and methods by which the maturing child can be gently led from its paridical world of fantasy into the hard and brittle place inhabited by grown-ups, so that it may be happy and confident and free from sterile conflicts. At the same time, this is a splendid manual of definitive psychology. Most highly recommended. From Methuen (36 Essex Street, W.C.2) at 21s.

BASIC PHYSICS, by E. J. Chambers, has the simplicity of treatment that comes from a real teacher. The elementary stages of physics are far more difficult than the advanced, and many anxious hours must be spent by hard-

working students poring over mediocre books. This need no longer happen, for Mr. Chambers' book lays down fairly and squarely the principles of mechanics, hydrostatics, heat, light, sound, magnetism and electricity as far as they are required for the General Science student. A good book indeed. From G. Bell (York House, Portugal Street, W.C.2) at 8s. 6d.

THIS AGE OF SCIENCE, by John Rowland, is a short but fairly adequate survey of selected fields in which science impinges on our lives. Dyes, plastics, drugs, planes, bombs and ghosts all come in for brisk and penetrating examination. There are slight errors here and there, but they do not in the least detract from the general value of the book. Recommended. From E. J. Arnold (Butterley Street, Leeds 10) at 4s. 6d.

HOW TO PRODUCE EFFECTS is the latest Focal Book, and fully as valuable as the rest. This one, by Julien Caunter, shows in minute detail and with a plethora of illustrations how to produce all manner of

interesting, amusing and elegant effects in cine-photography. It covers effects produced by exposure, focusing, lens, camera, diffusion, distortion, filters, fades, wipes, dissolves and other transitions. In the Focal tradition, the text is entirely without padding, is clear, and is cleverly supplemented by specially designed illustrations. Excellent. From Focal Press (31 Fitzroy Square, W.1) at 7s. 6d.

BOOLEAN ALGEBRA, by Edmund C. Berkeley, is a short account of this form of symbolic logic and its application to insurance problems. Using the insurance problems as a real basis, the author shows how this unconventional form of algebra can have practical applications. There is also a short resume of the algebraic system itself. From Edmund C. Berkeley & Associates (36 West 11th Street, New York 11, N.Y., U.S.A.) at \$1.50.

PRELUDE TO MATHEMATICS, by W. W. Sawyer (author of *Mathematician's Delight*), will surely have a wide popularity. This author has the uncommon knack of

making mathematics not only simple but also interesting. In this, his second book, he goes very deep into the entrenchments of advanced mathematicians, and shows us that these gentlemen are having a wonderful time. Here we have disarmingly simple treatments of such frightening subjects as non-Euclidian geometry, matrix algebra, projective geometry and determinants. Not in great detail, of course, but sufficient to indicate how easy and intriguing these things really are. Most highly recommended to all who are afraid of figures. From Penguin Books (Harmondsworth, Middlesex) at 2s. 6d.

KANT is another 2s. 6d. book from Penguin's. In it, S. Korner has examined the writings of this great German philosopher and has tried to disentangle them in such a way as to give a clear picture of Kant's ideas. A wealth of critical literature is available on Kant (bibliographised in this book) but few lucid expositions of the philosophy itself. Professor Korner (he holds the Chair of Philosophy in the University of Bristol) has done a remarkable job

and we recommend his book very highly.

A DICTIONARY OF PSYCHOLOGY fills a very great need. Put together by James Drever, formerly Professor of Psychology at Edinburgh University, and published by Penguins at 2s. 6d., this book contains many hundreds of terms that will help the layman to understand his Sunday papers better! Seriously, this is a very complete survey of the highly specialised terminology of psychology. Recommended.

SCIENCE NEWS 36—yet another Penguin bargain at 2s. 6d.—contains features on Growth, Regeneration and Tumour Growth, The Scintillation Counter, Size of Atomic Nuclei, Sulphur in Pictures, Fluidization, Plants' Movements and other interesting articles, including the usual comprehensive Research Report.

FICTION

ROCKET PILOT is a boy's book by Philip St. John. Jerry Blain is seventeen and he competes in an inter-

planetary race. Opposing him are wily Martians who will stick at nothing, and kindly Venusians. Jerry has a great many adventures before the expected ending. From Hutchinson (Stratford Place, W.1) at 7s. 6d.

THE MAN WITH ABSOLUTE MOTION, by Silas Water, sounds as though it might be a nice sensible book, but it is pure space opera with masses of unpronounceable words and peculiar humans and aliens like purple balls. The setting is thousands of years hence when the Earth's energy is running low and other supplies are being sought. There are several love stories and quite a few exciting adventures. Not at all a bad story, but quite two-dimensional. From Rich & Cowan (Stratford Place, W.1) at 9s. 6d.

ANGELO'S MOON is the attempt by an established author to turn out science fiction. It is far more successful than most other efforts have been. Unfortunately, exotic terms creep in again—and here they are explained by numerous footnotes which hold up the story terribly.

But this tale of a doomed Earth under famine conditions is interesting if not very original. From The Bodley Head (28 Little Russell Street, W.C.1) at 9s. 6d.

Two more Kemlo books appear to keep up the flow of this series. **KEMLO AND THE SPACE LANES** and **KEMLO AND THE CRATERS OF THE MOON** are the titles. As with the rest of the series, these are typical boys' books with Kemlo drinking lots of fruit juice and coming out on top in the end. The first is about a mysterious spectrum that Kemlo discovers, and the second is about a voyage to the Moon. As before, Kemlo and his friends have the useful knack of being able to live in space without spacesuits. Both books are illustrated. From Thomas Nelson (Parkside Works, Edinburgh 9) at 5s.

HELLFLOWER, by George O. Smith, is a fast, exciting story that manages to miss all the opportunities the plot gives for space opera—and increases in value accordingly. The flowers that form the title have a peculiar effect on women, so peculiar that Earth

is becoming demoralised and the authorities are worried about it. The hero is given the job of clearing up the mess, which he does, of course, having great fun in the meantime. A good book. From The Bodley Head at 9s. 6d.

A MIRROR FOR OBSERVERS, by Edgar Pangborn, is one of those mature American books that do so much to make science fiction accepted as a literary form. Packed with adult ideas and characters, worked out without plot devices and written in the fast, abbreviated language of the modern world, these books are almost hypnotic. Here we have the story of a child prodigy, sought for his genius by Earthmen and Martians alike. We'll say no more. Read it for yourselves. From Frederick Muller (110 Fleet Street, E.C.4) at 12s. 6d.

THE FITTEST is J. T. McIntosh's latest masterpiece. With this he has regained the eminence that he attained with *World Out of Mind* and *One in Three Hundred* and nearly lost with *Born Leader* (though this latter was an excellent book; just not quite good enough for McIntosh).

Once again we have mature writing, fast and intelligent, a paucity of plot devices, and real people moving through the pages. McIntosh is one of the very, very few British writers who can turn out this type of stuff. *The Fittest* is all about a world that has been reduced to anarchy and confusion by the multiplication of mutant animals—a world where only the fittest can survive. The story is as much an examination of what constitutes "fitness" as a narrative of adventure. It is enthralling from beginning to end. We recommend it most highly.



Projectiles

OVERSEAS SECTION

LATE POLL

Have just received issue No. 53 of *Authentic*, and as usual I immediately read your editorial first. I was very happy that you had included a poll with the view of improving the mag. But, one question and possibly a criticism. I see that the closing date for the poll was the 28th February. Now the question—is the percentage of fans in Australia and New Zealand large enough to influence the result of any such poll? If not, simply forget this letter. But if, perchance, the percentage is in any way large, possibly this letter will do some good. Speaking for myself and, I think, most SF fans out here, I am extremely interested in the future of *Authentic*. I regard it as by far the best of the English mags and

second only to *Astounding* with regard to all mags, English and American. Now, about the poll. It closed on February 28th. That is O.K. for your English readers, but for us down here, if our numbers count at all, is much too early. You see, issue No. 53 only gets to the bookstalls and shops on 24th March. Therefore, the poll is over and probably results published before we even receive the issue with the poll in it.

I see that No. 53 was or had a publishing date of Jan. 15th. That means that over two months time has elapsed. Like I said before, any fan who is a fan, takes an interest in *Authentic*, and would like to see it keep on improving as it has since it started. If it is possible and worthwhile from your point of view, could you allow more time for our answers and ideas to get to you? I know you will do what you can, but of course, if there are not enough of us out here to in-

fluence any poll or question, all fans will understand. It might be an idea for you to publish the percentages of fans in different countries. You must have an idea from the sales of mags. Even though it will not make any difference to the result, I'm enclosing my idea of what I would like to see in the mag by filling in the poll. I don't suppose one more opinion will do any harm.

Harry Smith, Box 53,
P.O. George Street North,
Sydney, Australia.

You may be sure, Harry, that the opinion of every single reader counts equally with us—even if he is the only fan in Peru or some such unlikely place. By now you will have seen that we repeated the poll; and your entry was as useful as the others. Thanks a lot for your interest. Magazines thrive on people like you.

PEN PALS

I am fourteen and would like to contact fans of my own age in America (if any). I would be grateful if you could publish this letter in your magazine.

Barry Itystein, 39 Newcastle Street,
Perth, Western Australia.

We don't doubt, Barry, that you'll receive lots of correspondence now. That "if any" rather puzzles us. There are more fans in America than in any other country. You'll see.

HOME SECTION

HORRIBLE

In issue 56 there is a story *Brutus* by G. Holt. You particularly asked for criticism of this. In actual fact you would have got mine, anyway. I think it is utterly horrible, unfit for a magazine such as *Authentic*. I should suggest that this type of thing is only suitable for horror comics and similar low-grade stuff. If you print any more of these ghastly stories of experiments on animals here is one loyal reader who will be lost to you. C. Cruse,

24 Wimbledon Park Road, S.W.18.

Do you demand that all stories be about the good and beautiful—when all around you is evil and suffering and ugliness? Do we close our eyes and ears and hearts to this and assume a cloak of sunny complacency? Or do we keep these things forever in our minds, realising that the fate of the universe is in our hands—each one of us?

SUSPIC

I was pleased to read the review of my new book FRONTIER TO SPACE in the May issue of *Authentic* but rather surprised at your reviewer's doubts concerning the photograph of the Earth taken by a Navy Viking from an altitude of 108 miles. The size of any object on the negative depends upon the field of view of the camera and,

as explained in the legend to the figure and in the text, this photograph was taken by a special wide-angle lens having a field of view of about 160 degrees. Photographs of this nature are not used pictorially to show how the Earth would appear to a human eye from that height but are used for determining rocket aspect as explained on page 41 of my book. I trust that this explanation may put the whole matter in its true perspective!

Eric Burgess, F.R.A.S.,
4 Cordova Avenue, Denton,
Near Manchester.

Thank you very much for taking the trouble to clear up this matter, Mr. Burgess. We are sure our readers will be most interested in your explanation. Once more we say that your book has great value.

COVERS GOOD—

I have just got to say something about A.S.F. Not about the stories themselves—which are perfect, of course—but about your brilliant covers which are getting better each month, especially Nos. 55 and 56, also Nos. 38 and 49. I feel I

must really congratulate the artist of these superb drawings.
D. Thomas, 31 Rickards Street,
Graig, Pontypridd, Glamorgan,
S. Wales.

Thank you, Mr. Thomas. Your kind words have been passed on to our artist.

—COVERS BAD

May I say what second-rate cover drawings Nos. 55 and 56 have had. Let's have this "Steps into Space" series continued. The No. 56 sixteen page extra was also a great disappointment, being of ordinary paper. In case you haven't noticed, the photographs haven't come out very well on that rough-surfaced paper. Why not have either a good sixteen page extra or none at all? The only thing that kept me from writing a threatening letter was Prof. Low's article. I think other readers will agree that No. 56 has let down your prestige tremendously.

M. A. Ross,
25 Farlow Road, S.W.15.

Sorry, Mr. Ross. You are a bit of an odd man out. Still, we agree about the illustrations, and you will see that we have improved them considerably.

BERYLLIUM—Contd. from page 28 aluminium, which has long been used for making firebrick for lining blast furnaces and for making porcelain crucibles. Beryllium oxide can be used for similar purposes in a very modern special case. There is a place for refractories in nuclear piles and, if they incorporate beryllium oxide their purpose is twofold. The nucleus of the beryllium atom has what is known as a moderator effect on the fast-moving particles released in thermo-nuclear reactions and moderation is one of the major problems involved in nuclear piles.

Beryllium carbide is also a potential refractory since it does not decompose below two thousand degrees and it may be used in the same way as beryllium oxide in the nuclear piles.

It will be seen that in both the uses already quoted for beryllium the total amount of beryllium employed is not large. In such other uses as I can describe the quantities become much smaller. In all of them beryllium is a very small percentage of alloys of other metals. Copper alloyed with fairly large quantities of other metals and only about one per cent. of beryllium produces a much stronger and harder metal than can be produced by any other of the many alloys of copper. There is another copper alloy containing much less than one per cent. of beryllium which has a very high electrical conductivity and, therefore, a value for purposes which are very limited in their scope but which are, nevertheless, very important. A highly corrosion resisting alloy is used in watches which contains chromium, manganese, cobalt, iron and a very small quantity indeed of beryllium. Many of the Swiss watchmakers now use a tungsten-nickel-iron alloy containing a small quantity of beryllium also which, besides being non-magnetic, has the horologically important virtue of maintaining a constant elasticity over a considerable range of temperature.

Photos: Beryllium Smelting Co. Ltd.

BURNING TO GO

Continued from page 21

to use the word fuel in a wider sense than that of the schoolboy's definition "something used for burning." By burning we shall probably mean something other than the oxidation of substances as in ordinary fires. The earliest propellant powder was gunpowder, in which oxygen was supplied by saltpetre to sulphur and charcoal to form volumes of hot gas. There are thousands of other known combinations of chemicals which will provide large volumes of gas at varying speeds.

It may well be that the vessel will need on its journeyings a supply of not one fuel, but of several. While it is making its way through the atmosphere there will be a limit to its speed, since it must not move so quickly through our air that its surface becomes over-heated. Also as the force of gravity upon it diminishes, the driving force required will rapidly decline and a complete change-over from one fuel to another may be necessary, at least once, and possibly two or three times.

Even for the comparatively simple journey of the V-2 rocket the fuel which hurled it along a hundred miles above the Earth was not suitable for getting it off the Earth.

Rocket fuel research is still mainly concerned with chemical reactions, and it is in terms of such that I have written. Adequate control of thermo-nuclear reactions will, I believe, eventually enable us to dispense with chemical fuel except for small scale specialised purposes. It is anybody's guess which comes first, space travel or the harnessing of the atom.

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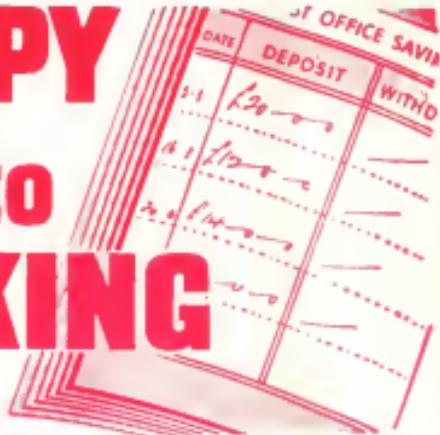
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